

MONTHLY WEATHER REVIEW,

DECEMBER, 1881.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to January 20th, 1882, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 133 Signal Service stations and 14 Canadian stations, as telegraphed to this office; 193 monthly journals and 160 monthly means from the former, and 14 monthly means from the latter; 215 monthly registers from Voluntary Observers; 58 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; Marine Reports through the co-operation of the New York Herald Weather Service; monthly reports from the local Weather Services of Iowa, Nebraska and Missouri, and of the Central Pacific Railway Co.; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

To illustrate the subject of the distribution of mean atmospheric pressure over the United States and Canada for the month of December, 1881, chart No. II has been prepared, upon which are traced the lines of equal barometric mean values. The areas of lowest mean pressure cover the northern portion of the Canadian Maritime Provinces and northern Minnesota, lowest barometers at Father Point and St. Vincent, 29.99 and 30.03 respectively. The areas of highest mean pressure cover Virginia and the South Atlantic States, the Middle and Northern Slopes and the Middle and Northern Plateau Regions, highest barometers, 30.24, at Augusta, Charlotte and Knoxville, and 30.36 at Salt Lake City. Higher readings, but of doubtful certainty owing to elevation, are reported from the Plateau Regions as follows: Eagle Rock, 30.50; Helena and Missoula, 30.55. The regions of lowest mean pressure and of largest deficiencies, coincide with the path of greatest storm disturbance as indicated by a comparison of charts Nos. I and II. Compared with the previous month, there has been a considerable fall in pressure throughout the Atlantic Coast States, and a compensating rise to the westward, except in the Northern Pacific Coast Region, where the largest comparative fall occurs.

Departures from the Normal Values for the Month.—Compared with the means of previous years, the mean pressure for the present month is generally above the normal throughout the country east of 87th and west of the 100th meridians. In these separate areas of excess the regions of greatest departure are found on the northeastern portion of the North Carolina coast, in New Jersey, northern New England and from Colorado and Wyoming westward to the Pacific. The departures of excess range from 0.01 to 0.16 inch, the largest being reported from Mt. Washington. The principal area of deficiency in mean pressure is a very irregular one, and is found rather anomalously, to follow very closely portions of the Mississippi and Missouri rivers. Commencing with New Orleans, the departures of deficiency are found with regularity at every station until Cairo is reached, when a small area of slight excess is encountered, extending northward to the northern boundary of Iowa. Beginning again at St. Paul, the departures of deficiency continue northward to Duluth and northeastward to St. Vincent. On the Missouri the departures of deficiency begin at Leavenworth and continue without change to Fort Buford. Small areas of deficiency are found in southern Florida, southern California and northeastern Oregon. The departures of deficiency range from 0.01 to 0.14 inch the largest occurring at St. Vincent.

Stations reporting a normal condition are as follows: Davenport, Montgomery, Marquette, St. Louis and Wilmington.

Barometric Ranges.—The range of pressure for the present month has generally varied from 0.75 to 1.2 inches, and in the extremes from 0.27 inch at Key West and 0.3 inch at Los Angeles, to 1.24 inches at Fort Assinnaboine, and 1.51 inches at Eastport. The ranges increase with the latitude on both the Atlantic and Pacific coasts, and from Florida and Southern California inward to the maximum in Texas. Throughout the several districts the monthly barometric ranges varied as follows: New England, from 1.33 inches at New London to 1.51 inches at Eastport; Middle Atlantic States, 1.09 inches at Lynchburg to 1.3 inches at New York City; South Atlantic States, 0.62 inch at Jacksonville to 1.03 inch at Kitty Hawk. Florida Peninsula, 0.27 inch at Key West to 0.46 inch at Cedar Keys; Eastern Gulf States, 0.63 inch at New Orleans to 0.8 inch at Mobile; Western Gulf States, 0.6 inch at Galveston to 0.88 inch at Shreveport and 0.91 inch at Mason; Rio Grande Valley, 0.65 inch at Brownsville to 0.82 inch at Laredo and 0.84 inch at Brackettville; Ohio Valley and Tennessee, 0.79 inch at Nashville to 1.1 inches at Morgantown; Lower Lake Region, 0.96 inch at Sandusky to 1.17 inches at Oswego; Upper Lake Region, 0.93 inch at Chicago to 1.19 inches at Marquette; Upper Mississippi Valley, 0.85 inch at Des Moines to 0.95 inch at Madison; Missouri Valley, 0.81 inch at Omaha to 1.23 inches at St. Vincent; Extreme Northwest, 1.13 inches at Moorhead to 1.23 inches at Ft. Buford; Southern Slope, 0.59 inch at El Paso to 0.92 at Henrietta; Middle Slope, 0.64 inch at Pike's Peak, to 0.91 inch at Ft. Elliott; Northern Slope, 0.81 inch at Cheyenne to 1.23 inches at Ft. Benton and 1.24 inches at Ft. Assinnaboine; Northern Plateau, 0.85 inch at Eagle Rock to 1.23 inches at Umattilla; Middle Plateau, 0.69 inch at Winnemucca to 0.74 inch at Salt Lake City; Southern Plateau, 0.43 inch at Florence to 0.6 at Camp Thomas and La Mesilla; South Pacific Coast Region, 0.3 inch at Los Angeles and 0.31 inch at Campo to 0.49 inch at Visalia and 0.5 inch at Yuma; Middle Pacific Coast Region, 0.46 inch at San Francisco to 0.99 inch at Red Bluff; North Pacific Coast Region, 1.07 inches at Portland to 1.22 inches at Olympia.

Areas of High Barometer.—Nine of the principal areas of high pressure* for the month of December, 1881, appeared within the limits of the Signal Service weather maps and are described as follows:

No. I.—On the 1st of the month this area was central in Indian Territory, and extended rapidly to the northeast, the temperature falling from 10° to 20°; this fall was not sufficient however to reach the normal as the temperature on the morning of the 1st was above the normal from 10° to 20° in the districts east of the Mississippi river.

No. II.—Appeared over the Northern Slope on the morning of the 3d, it extended to the south during the day, to the northeast on the 4th, so that by the afternoon of the 5th, the highest barometer was in New England. No decided fall of temperature resulted from this area, it remaining generally above the mean for the month.

No. III.—Appeared over Montana on the morning of the 6th; the next morning it was central in Kansas, on the 8th in Ohio, and on the 9th on the North Carolina coast. During the 6th the temperature fell over the Lake Region and in the Upper Mississippi and Missouri Valleys from 10° to 20°, and by the morning of the 8th the cold wave extended to the Atlantic coast.

No. IV.—The morning map of the 8th showed an area of high barometer over Montana. The pressure increased and extended rapidly to the east during the day, and was accompanied by a fall of temperature of from 10° to 30°. On the morning of the 10th the barometer was highest in Indiana, the greatest rise (from 0.50 to 0.65 inch) occurring in the St. Lawrence Valley. The fall in temperature followed closely the rise in the barometer, being 26° at Montreal and 30° at Rockcliffe in Ontario. During the 10th the centre of the area moved eastward to the Atlantic coast, with a fall in temperature from Maine to Florida. The minimum temperatures for the month occurred at a large number of stations in New England and the Middle Atlantic States on the 11th. The pressure remained high on the Atlantic coast during the 12th and 13th.

No. V.—This area first appeared on the California coast on the 11th; during the day it moved to the northeast and on the morning of the 13th was central in Dakota, the temperature in last 24 hours having fallen from 10° to 30° west of the Mississippi river. The area of highest barometer was in Colorado and Kansas on the morning of the 14th, the pressure having increased 0.64 inch at Leavenworth in 24 hours. The temperature had fallen from 15° to 30° from the Lake Region to Texas. On the 15th the highest barometer was in the Ohio Valley, and during the 16th, 17th, 18th and 19th on the Middle and South Atlantic coasts. The minimum temperatures for the month occurred at several stations in New England and the Middle Atlantic States on the 16th.

No. VI.—A considerable rise of the barometer occurred in Oregon on the 15th; this increased pressure moved into the Extreme Northwest on the 16th, into Wyoming on the 17th, over the Lakes on the 18th, and over the Canadian Maritime Provinces on the 19th. On this date it joined with the high barometer that had existed along the Atlantic coast since the 16th. The

passage of this wave of high pressure was accompanied by a fall of temperature of from 5° to 10° . The pressure did not at any time rise high enough to mark it as a centre of high barometer, for during the entire time of its passage from Oregon to Halifax the highest barometer was either on the Middle or South Atlantic coast.

No. VII.—A wave of high pressure entered the United States over the Oregon coast on the 18th. The pressure to the eastward increased rapidly. On the morning of the 20th the highest barometer was in Montana. During the day it passed east of the Lake Region, and northerly winds prevailed north of the 40th parallel. The centre reached the Atlantic coast on the 21st, where the barometer remained highest until the 22d, when the pressure rapidly diminished.

No. VIII.—The morning map of the 22d showed an increased pressure from the Pacific coast to the Missouri river. During the day the increased pressure extended as far east as Lake Erie and from British America to the Gulf of Mexico. This extended area moved directly east to the Atlantic coast. The centre of highest pressure was in the Ohio Valley on the 24th, and on the Middle Atlantic coast on the 25th. The afternoon map of 24th, showed a rise of 0.91 inch at New Haven and New York, and 0.94 inch at Delaware Breakwater in last 24 hours. Dangerously high winds prevailed on the Atlantic coast on the 23d and 24th.

No. IX.—During the 27th the barometer rose 0.7 inch in Washington Territory. During the 28th, this area of increased pressure covered the whole country west of the Mississippi river, the highest barometer being in Idaho. This extended area moved eastward, reaching the Atlantic coast on the 30th. On the 31st, the greatest rise occurred in the Canadian Maritime Provinces. The centre of highest pressure was in Nebraska on the 29th and in Texas on the 30th. During the 31st the pressure fell rapidly in the Gulf States, and the centre of highest barometer was transferred to the Extreme Northwest. On the 30th and 31st, the minimum temperatures for the month occurred in the Upper Mississippi and Missouri Valleys and at many of the stations in the Lake Region and the Middle Atlantic States.

Areas of Low Barometer.—The paths of ten areas of low barometer are charted for the month of December, 1881. Six of these can only be charted approximately. In all the others the centre passed within the limits of the observation offices of the Signal Corps.

No. I.—Is a continuation of No. XVI, described in the November REVIEW. During the 15th it moved across New England and disappeared over the Gulf of St. Lawrence accompanied by rain in New England and the Middle Atlantic States. The following reports furnished through the co-operation of the New York Herald Weather Service probably indicates the presence of this storm during its passage eastward over the ocean: S. S. *Wisconsin*, 4th, in $48^{\circ} 37' N.$, $37^{\circ} 17' WNW.$, furious gale, heavy confused sea. 5th, in $47^{\circ} 18' N.$, $42^{\circ} 39' W.$, $WNW.$, strong gale. S. S. *City of New York*, 4th, in $48^{\circ} 45' N.$, $40^{\circ} 59' W.$, strong NW. gale, very heavy head sea. S. S. *Servia*, 3d, in $46^{\circ} 39' N.$, $39^{\circ} 25' W.$, violent SW. to NW. gales and heavy squalls; 4th, in $44^{\circ} 51' N.$, $45^{\circ} 12' W.$, NW. squalls, with high sea. S. S. *Anchoria*, 3d, morning, in $48^{\circ} 25' N.$, $42^{\circ} 41' W.$, 29.20 to 29.60, heavy NW. gale; afternoon, in $48^{\circ} N.$, $43^{\circ} 20' W.$, 29.60 to 29.85, heavy westerly gale. 4th, in $47^{\circ} 17' N.$, $44^{\circ} 22' W.$, 29.89 to 29.94, $WNW.$ and $NW.$ strong gales with snow, very high sea.

No. II.—Was a slight depression, whose centre can only be approximately located during the 4th. Cloudy weather and light snow prevailed during this day in the Lake Region.

No. III.—This area first appeared in western Montana on the night of the 4th. It moved eastward during the 5th and 6th, causing southerly winds as far south as latitude $40^{\circ} N.$ and accompanied by rain or snow. On the 7th high W. and NW. winds prevailed over the Lake Region. A new depression appeared in the Northwest on this date as the winds backed to the south. By the morning of the 8th the centre had moved into New Brunswick. Cautionary signals ordered for this storm were justified by velocities ranging from 25 to 48 miles per hour. The following reports furnished through the co-operation of the New York Herald Weather Service indicates the presence of this storm as it passed eastward over the ocean. S. S. *Switzerland*, 8th, in $46^{\circ} 49' N.$, $45^{\circ} 48' W.$, 29.75, S. to W., force 4, overcast and rain. 9th, in $45^{\circ} 50' N.$, $49^{\circ} 57' W.$, 29.94, W. and NNW., strong gales, high head sea. 10th, in $44^{\circ} 42' N.$, $54^{\circ} 14' W.$, 29.99, WSW. to NNE., strong gales with snow.

No. IV.—Appeared in the Extreme Northwest on the afternoon of the 7th, and moved slowly eastward with very little precipitation and moderately high winds.

No. V.—Appeared in Upper Missouri Valley on the 11th. On the afternoon of the 12th the centre was west of Lake Superior near Duluth and by midnight had moved southwest into Iowa. It then moved off to the northeast and disappeared on the night of the 3d. During the passage of this storm, heavy and extensive rains occurred in New England, the Middle Atlantic States and Lake Region, and high winds prevailed in the Lake Region and on the Atlantic coast.

No. VI.—Appeared in the Extreme Northwest. On the morning of the 15th it passed slowly eastward without rain or high winds and on the 18th disappeared over the Canadian Maritime Provinces. The pressure fell below the normal at a few of the most northern stations only, and

as it remained high in the southern portion of the United States a mass of warm and dry air was carried far north, the temperature rising from 10° to 25° above the normal at stations north of latitude 35° N.

No. VII.—This depression passed north of the Lake Region on the 18th and 19th, unattended by marked atmospheric changes in the United States. The temperature and pressure both remained above the normal at all stations east of the Rocky Mountains and fair weather generally prevailed.

No. VIII.—This area, accompanied by heavy rain, moved up from the coast of Texas during the 19th, and on the morning of the 20th was central in Arkansas. By the next morning it had moved into northern Missouri and thence passed directly east and was central off the Atlantic coast on the morning of the 23d. The temperature remained above the normal and heavy rain-falls occurred in all districts east of the Mississippi. High winds prevailed over the Lake Region and on the Atlantic coast. The following reports furnished through the co-operation of the New York Herald Weather Service, indicate the presence of this storm as it passed eastward over the ocean: S. S. *New York*, 22d, in $38^{\circ} 14'$ N., $74^{\circ} 25'$ W., 30.22, ESE., light cross sea, increasing gales with light rain; 23d, in 35° N., $75^{\circ} 23'$ W., 29.80, WSW., moderate gale, cloudy weather; 24th, in $33^{\circ} 02'$ N., $78^{\circ} 25'$ W., 30.31, NNE., fresh, clear and fine weather. S. S. *Gallia*, 25th, morning, in 42° N., $50^{\circ} 47'$ W., 29.75, NW., force 8, high, confused sea, squally with rain and snow; noon, in $42^{\circ} 46'$ N., $51^{\circ} 27'$ W., 29.75, NW., force 8 to 9, high confused sea, squally with rain and snow; 26th, morning, in $41^{\circ} 53'$ N., $57^{\circ} 28'$ W., 30.43, W., force 4, dull, cloudy weather. S. S. *P. Caland*, 23d, in $44^{\circ} 44'$ N., $55^{\circ} 51'$ W., 29.81, SSW., force 5, squally, with rain; 24th, in $43^{\circ} 28'$ N., $60^{\circ} 16'$ W., 29.30, NE., force 9, squally, with rain; 25th, in $41^{\circ} 53'$ N., $63^{\circ} 39'$ W., 30.42 NW., force 4, fine weather.

No. IX.—The midnight map of the 24th indicated a storm in the Gulf of Mexico. By the next afternoon its centre was located near Port Eads. From this point its path is charted until the centre had passed off the New Jersey coast on the 27th. This storm was accompanied by heavy rain. The temperature everywhere remained above the normal. The following high velocities are reported: Port Eads, E. 52 miles; Mobile, SE. 36; Pensacola, SE. 40; Jacksonville, SW. 27; Smithville, S. 40; Macon, SW. 46; Hatteras, E. 28.

No. X.—This area entered the United States in the Extreme Northwest from British America. On the 28th passed north of the Lake Region and at midnight of the 29th was central between Oswego and Kingston. It then passed down the St. Lawrence Valley and disappeared on the 30th. Rain fell in the Lake Region, New England and the Middle Atlantic States, and snow in the Lake Region. After the centre had passed to the eastward the barometer fell from 0.3 to 0.5 below the normal in the Lake Region, and from 0.5 to 1.28 inches in New England and the Maritime Provinces of Canada. High winds prevailed in the Lake Region and on the New England and Middle Atlantic coasts.

INTERNATIONAL METEOROLOGY.

International charts Nos. IV and V accompany the present REVIEW for December 1881. The former is published for October, 1879, and continues the series of this chart commenced in January, 1877. Owing to the failure of receiving the October, 1879, number of the "Beobachtungen auf dem Nordatlantischen Ocean," kindly furnished this office through the courtesy of Prof. Dr. G. Neumayer, Director of the German Marine Observatory, chart No. IV is not as complete over the North Atlantic Ocean as in previous months. Chart No. V is prepared for the month of January, 1880, and continues the series of this chart commenced in November, 1877.

Chart No. IV shows the mean pressure, temperature and the prevailing direction of the wind at 7.35 a. m., Washington, or 0.43 p. m. Greenwich mean time, for the month of October, 1879, over the Northern, and at certain isolated stations in the Southern Hemisphere. The most decided area of barometric minima for the present month covers the southern half of Greenland and extends thence eastward between the parallels of 60° and 70° N. over northern Scandinavia and northwestern Russia. A second area of barometric minima covers the whole of British India and a portion of western Russia the barometer falling below 29.90; elsewhere the pressure remains 30.00 or above except at certain isolated stations. Throughout the Northern Hemisphere north of 50° N. the barometer does not fall with regularity as the latitude increases, except between the meridians of 80° E. and 90° W., and again between 120° and 160° E., where there is not only a noticeable regularity in the fall northward, but also the presence of a marked rapidity. To break the continuity of this diminution of pressure in northern latitudes, two areas of high pressure push northward, one between the meridians of 80° and 120° E. and the other between 90° and 130° W. There are five principal areas of high pressure situated as follows: 30.25 in southern Siberia, 30.20 over the Azores, 30.20 in Tennessee and the southern portion of the Middle Atlantic States, 30.20 in the Northern Plateau, and 30.20 in central Mexico. There is a marked diminution of pressure over the Atlantic north of 30° N. and between the meridians

of 30° and 60° W. as compared with September. A similar change has taken place over southern Russia. The extreme mean pressures for the month are 29.65 (lowest) at Tromso and Stykkisholm, and 30.27 (highest) at Mexico and Nertschinsk. The extreme monthly range of mean pressure is 0.62 inch, which is 0.18 smaller than the range for October, 1877 and 1878, the range being the same (0.80 inch) for both the latter years. The following extreme monthly mean temperatures are given in Fahrenheit's scale: *lowest*, York Factory, 26°; Nertschinsk, 29°; Godthaab, 31; Nikolaievsk on the Amoor, 33°; Yeniseisk, and Virginia City, 35°; Haparanda, Tromso and Fort Garry, 37°; Fort Buford, 38°; Archangel, 39°; Stykkisholm and Barnaul, 41°; Moose Factory, 43°; *highest*, Deesa, 87°; Freetown, 85°; Kurrachee, 84°; St Thomas, 83°; Bridgetown and Paramaribo, 82°; Macao, 81°; Nassau, Navassa and Biskra 80°; Fort de France, 79°. The prevailing direction of the winds over the United States, was *northeast* to *southeast* south of parallel 40° N., and east of 100° W.; north of the above parallel and east of the same meridian, *southerly*, except *westerly* along the Atlantic coast; in the remaining portion of the country *variable*. Over Canada and in the Maritime Provinces, *southwesterly*; In central Mexico, *calms*. Over the Atlantic Ocean, *northeasterly* from the European coast westward to 30° W., and from the American coast eastward to 60° W.; between these meridians the directions are *southeast*, *southwest* and *northwest*. In Europe *westerly* over the British Isles; *northwesterly* over Scandinavia and thence southward to parallel 40° N., except *northeasterly* in Italy and France; south of 40° N., *variable* and in Russia *southerly*. In Hindostan, frequent *calms* with occasional winds generally from the *northwest*. Over the Japan Islands and along the Asiatic coast, *northeasterly*. Compared with October, 1877 and 1878, the temperature over the United States is generally higher, particularly west of the 100th meridian and the pressure shows a marked rise in the Atlantic Coast States and in the northern Rocky Mountain and Plateau districts. Over the Atlantic there is a decided rise in pressure off the Middle and South Atlantic coasts and in the vicinity of the Azores. The changes in temperature are very small and the tendency north of parallel 50° N. is a fall. In the various countries of Europe and Asia the following changes appear: in the British Isles the temperature is from 1° to 5° higher and the pressure from 0.18 to 0.4 inch lower. In France the temperature is slightly lower and the pressure from 0.01 to 0.15 inch higher. In Scandinavia the temperature is slightly lower and the pressure from 0.01 to 0.08 inch higher. In Germany the temperature shows but little change while the pressure is from 0.01 to 0.17 inch higher. In Austria and Hungary the temperature is generally lower and the pressure generally higher. In Italy the temperature shows but little change while the pressure is generally higher. In Spain and Portugal the temperature is slightly lower and the pressure is from 0.01 to 0.08 inch higher. In Algeria the temperature is from 1° to 4° higher and the pressure shows a rise of 0.01 to 0.05 inch. In Russia the temperature is generally higher while the pressure is from 0.05 to 0.20 inch lower. In British India the temperature is from 1° to 4° higher while the pressure generally shows very little change. The accompanying table shows the deviations in temperature and barometer at isolated stations for the month of October, 1879, as compared with the means of the past two years:

Comparative Thermometric and Barometric Means, with corresponding Departures.

STATION.	Mean Temperature.			Mean Barometer.			STATION.	Mean Temperature.			Mean Barometer.		
	Oct., 1877-78.	Oct., 1879.	Departure.	Oct., 1877-78.	Oct., 1879.	Departure.		Oct., 1877-78.	Oct., 1879.	Departure.	Oct., 1877-78.	Oct., 1879.	Departure.
York Factory	22.1	26.1	+4.0	29.96	30.03	+0.07	Bridgetown	83.0	81.6	-1.4	29.92	29.96	+0.04
Godthaab	30.2	30.7	+0.5	29.75	29.65	-0.10	Navassa	81.5	80.0	-1.5	29.92	29.92	Norm'l
Stykkisholm	37.4	41.4	+4.0	29.61	29.75	+0.15	Medellin	66.1	65.2	-0.9	.....	.....	.....
Tromso	37.6	36.5	-1.1	29.58	29.65	+0.07	San Jose de Costa Rica	67.7	66.9	-0.8	.....	.....	.....
Thorshavn	46.2	45.7	-0.5	29.53	29.87	+0.34	Mexico	55.9	50.9	-5.0	30.15	30.16	+0.01
Archangel	38.1	38.5	+0.4	29.79	29.72	-0.07	Melbourne	54.3	55.4	+1.1	30.01	29.97	-0.04
Ekaterinburg	41.1	44.8	+3.7	30.12	30.10	-0.02	Hobart Town	51.0	56.0	+5.0	29.77	29.78	+0.01
Barnaul	37.6	40.5	+2.9	30.21	30.20	-0.01	San Juan de Puerto Rico	81.6	79.9	-1.7	29.90	29.98	+0.08
Yeniseisk	30.8	35.1	+4.3	30.09	30.24	+0.15	Nassau	70.8	80.2	+9.4	29.95	30.00	+0.05
Nikolaievsk on the Amoor	34.6	32.5	-2.1	.....	.....	.....	Havana	79.3	79.0	-0.3	29.93	29.92	-0.01
Pekin	51.6	51.4	-0.2	30.17	30.21	+0.04	Astrakhan	57.4	59.7	+2.3	30.20	30.14	-0.06
Zi-Ka-Wel	58.1	59.5	+1.4	30.17	30.20	+0.03	Athens	72.6	69.8	-2.8	30.03	30.02	-0.01
Tokel	57.6	60.5	+2.9	30.04	30.10	+0.06	Lahore	81.7	82.4	+0.7	29.84	29.82	-0.02
Tashkend	54.3	55.8	+1.5	30.31	30.15	-0.16	Tiflis	64.9	67.3	+2.4	30.11	30.07	-0.04
Nukus	55.5	61.2	+5.7	30.20	30.17	-0.03	Laghouat	72.3	75.0	+2.7	30.10	30.12	+0.02
Beirut	81.1	77.0	-4.1	29.90	29.99	+0.09	Fort de France	81.6	79.2	-2.4	29.82	29.98	+0.16
Manritius	75.6	73.9	-1.7	30.08	30.12	+0.04	Yokohama	59.5	59.6	+0.1	29.97	30.06	+0.09
Fort Napier	73.5	73.5	0.0	29.54	29.60	+0.06	Lisbon	67.8	66.0	-1.8	30.07	30.06	-0.01
Cape Town	68.8	66.6	-2.2	30.02	30.07	+0.05	Madrid	65.9	66.4	+0.5	.....	.....	.....
Free Town	83.4	85.4	+2.0	29.93	29.92	-0.01	Cagliari	70.3	70.7	+0.4	29.99	30.04	+0.05
Paramaribo	80.7	82.1	+1.4	29.97	30.01	+0.04	Gibraltar .....	.....	.....	.....	30.08	30.00	-0.08
Funchal	73.4	73.0	-0.4	30.10	30.10	Norm'l	Sandwich Manse	49.4	48.2	-1.2	29.63	30.01	+0.38
Ponta Delgado	69.2	72.1	+2.9	30.09	30.20	+0.11	Malta	73.5	72.1	-1.4	30.00	29.99	-0.01
Angra	66.1	68.7	+2.6	30.07	30.20	+0.13							

Chart No. V.—This chart displays the tracings of the probable courses of twenty-two of the principal storm areas of the Northern Hemisphere for the month of January, 1880. The approximate paths of progressive movement are based upon daily simultaneous international observations to the number of over 650, besides a large mass of irregular data which reaches this office

in various ways from the logs of vessels of the *Merchant Marine* of the North Atlantic and North Pacific oceans. Concerning the general distribution of the paths of the areas of barometric minima the following is given: fifteen areas traversed portions of the United States, eight of which came from the Pacific ocean, three from the British Possessions, one from the Gulf of Mexico and one a continuation of area No. XXXII of the December, 1879, chart. Twelve of these areas reached the Atlantic ocean, five of which crossed the same to the mainland of northern Europe and one passed southeastward from Newfoundland to the northwestern coast of Africa. Over the Atlantic ocean one area appears in about 60° N., 20° W., as a continuation of area No. XXX of the December, 1879, chart. In Europe four areas first appeared off the northwestern coast of Norway and one in southwestern Russia. Off the Asiatic coast one area passed northeastward south of the Japan Islands. Of the storms in North America the following detailed descriptions are given:

No. I.—This area is a continuation of No. XXXIV of the December, 1879, chart. Passing rapidly eastward from the Pacific coast during the 31st of December, 1879, the depression was central in Manitoba on the following day, January 1st, 1880. Ft. Garry, 29.31, a fall of 0.73 inch in past 24 hours, S., clear; Ft. Buford, Montana, 29.20, a fall of 0.74 inch, SW., clear; Pembina, Dak., 29.26, a fall of 0.76 inch, S. fair. 2d, depression central over northern Canada inclosed by the isobar of 29.60; Moose Factory, James Bay, 29.60, a fall of 0.39 inch, wind shifted from SW. to NW. with stormy weather. During the day the depression passed rapidly eastward to the Atlantic ocean, combining with area No. II on the 3rd. The following reports from Godthaab, Greenland, indicate the influence of this depression north of its centre: 2nd, 29.41, ENE., force 2, cloudy; 3rd, 29.17, NE., force 4, cloudy; 4th, 29.36, NW., force 4, cloudy; 5th, 29.43, N., force 4, fair; 6th, 29.67, NW., force 2, cloudy. The low barometers of the 1st and 2d at Godthaab, were due to the influence of area No. XXX of the December, 1879, chart, from which the surrounding pressure had not completely recovered before the passage of areas Nos. I and II.

No. II.—This area is charted as a continuation of area No. XXXII of the December, 1879, chart. On the 1st, central southeast of Nova Scotia followed to the westward over New England and in the Canadian Maritime Provinces by winds shifting to northwesterly with rapidly rising pressure. In 45° N., 58° W., 29.67, NE., force 6, rain; Sydney, N. S., 29.72, NE., heavy snow; Charlottetown, 29.76, W., heavy snow; St. Pierre, N. F., 29.72, E., snow; Little Glace Bay, N. S., 29.64, NE., heavy snow; in $40^{\circ} 40'$ N., $65^{\circ} 05'$ W., N. S. and NW., variable winds, confused sea, heavy storm; in $45^{\circ} 30'$ N., $50^{\circ} 20'$ W., SSW. to NNW., heavy gale, terrific squalls. 2nd, depression central in about 50° N., 40° W.; in $46^{\circ} 03'$ N., $41^{\circ} 42'$ W., 29.53, NW., force 7, high sea and rain; in $49^{\circ} 50'$ N., $30^{\circ} 45'$ W., 29.19, SW., force 9, high sea and rain; in 44° N., 55° W., SW. to NW., severe gales, high sea; in $46^{\circ} 29'$ N., $39^{\circ} 39'$ W., SW. to NW., hard gales, hail and rain, high confused sea; in $48^{\circ} 25'$ N., $33^{\circ} 45'$ W., NW. to SW., hard gales, high cross sea; in 47° N., 28° W., hurricane from SW., lost boat and davits; in $49^{\circ} 50'$ N., $27^{\circ} 06'$ W., WNW. to WSW., rain, high westerly sea. During the 3rd and 4th the depression passed northeastward to Iceland, being central on the 5th north of Stykkisholm. The following observations were reported from this station during the approach and passage of the depression: 3rd, 29.10, SE, force 7; 4th, 28.91, S., force 8, rain; 5th, 29.04, SW., force 4, snow; 6th, 29.77, S., force 5, rain. During the 6th the depression entered the northwestern coast of Norway; Tromso, 29.54, a fall of 0.27 inch in past 24 hours, SW., rain. 7th, depression central with diminished energy over Lapland; Haparanda, 29.81, a rise of 0.07 inch, wind shifted to west; Archangel, 29.67, a fall of 0.31 inch, S., cloudy. During the day the course of the depression changed from east to south and on the morning of the 8th, it was central between the Gulf of Finland and the White Sea. St. Petersburg 29.59, a fall of 0.21 inch, SSE., cloudy; Archangel, 29.65, a fall of 0.02 inch, SE., cloudy; Dorpat, 29.45, a fall of 0.53 inch, SSW., cloudy. Continuing its southerly course the depression was central north of the Black Sea on the 9th. Kieff, 29.63, a fall of 0.37 inch, N., snow; Nikolaiev, 29.52, a fall of 0.50 inch, W. 45 miles, snow; Lugan, 29.62, a fall of 0.28 inch, E., cloudy; Astrakhan, 29.91, a fall of 0.10 inch, calm, cloudy. During the day the course of the depression changed to the east and on the following morning it was central, with diminished energy, between the Black and Caspian seas. Kieff, 30.25, a rise of 0.62 inch, NW., clear; Nikolaiev, 30.17, a rise of 0.65 inch, NNW., clear; Lugan, 29.67, a rise of 0.05 inch, E., cloudy; Astrakhan, 30.00, a rise of 0.09 inch, SE., cloudy. During the 10th and 11th, the depression disappeared over Toorkistan in a high pressure area, 30.25.

No. V.—This area entered the Pacific coast on the 2d, in latitude 50° N., accompanied in British Columbia by easterly gales with sleet and snow, and to the southward, in Washington Territory and Oregon, by southeast to southwest winds and rain. During the day the depression moved rapidly eastward to the Saskatchewan valley, attended by comparatively light precipitation. 3d, central in Manitoba; Ft. Garry, 29.50, a fall of 0.75 inch, S., fair; Fort Buford, Montana, 29.39, a fall of 0.26 inch, W., cloudy. Continuing its easterly course, the depression was central east of James Bay on the 4th; Moose Factory, 29.56, a rise of 0.08 inch, W., cloudy. During the 4th and 5th the course of the depression, as indicated upon the chart, is rather doubtful, owing to the lack of reports from the region north of 50° N. The following report from St. Johns, N. F., on the 5th, indicates the presence of this depression north of Newfoundland on that date: barometer, 29.57, a fall of 0.95 inch, W., snow. 6th, depression central in about 50° N., 40° W.; in $45^{\circ} 43'$ N., $45^{\circ} 07'$ W., SW. to NW. and N.,

moderate gales, squalls of rain, high westerly sea; in $49^{\circ} 18' N.$, $37^{\circ} 13' W.$, WNW., strong gale, high westerly sea; in $43^{\circ} 16' N.$, $51^{\circ} 02' W.$, NNW., heavy gale, high westerly sea; in $47^{\circ} 24' N.$, $40^{\circ} 38' W.$, SW. to WNW., strong gale, very high sea; in $48^{\circ} N.$, $34^{\circ} W.$, E. to SW. and NW. moderate, increasing to strong gales. 7th, in $44^{\circ} 29' N.$, $46^{\circ} 47' W.$, NNW. and W., strong gale with violent squalls of snow; in $47^{\circ} 26' N.$, $44^{\circ} 12' W.$, N., strong gale, high sea; in $46^{\circ} 22' N.$, $45^{\circ} 40' W.$, SW. to WNW., strong gale, high sea; in $46^{\circ} 26' N.$, $39^{\circ} 27' W.$, NW., fresh gale, very high sea; in $49^{\circ} 21' N.$, $27^{\circ} 58' W.$, S. to NW., strong gale, vessel hove to for three hours. During the approach and passage of this storm the following observations were reported from Stykkisholm, Iceland: 6th, 29.77, S., force 6, rain; 7th, 29.37, S., force 8, rain; 8th, 29.74, S., force 7, rain; 9th, 29.70, SE., force 7, cloudy. The following observations were reported from Godthaab, Greenland: 5th, 29.43, N., force 4, fair; 6th, 29.67, NW., force 2, cloudy; 7th, 29.06, NE., force 6, fair; 8th, 29.15, NNE., force 4, fair; 9th, 29.69, NNE., force 4, fair. So far as can be judged from the daily charts, the atmospheric conditions at Godthaab indicated that the preponderating influence of area No. V began on the 5th, while area No. II was central north of Stykkisholm. By the morning of the 10th, with considerably diminished energy, this depression had reached the northern coast of Norway. 11th, depression probably central over the Arctic ocean north of Lapland; at Haparanda the barometer rose to 30.33, with southerly winds, but fell slightly at Tromsø, with a southwest wind. 12th, central east of the White Sea; Archangel, 29.47, a fall of 0.88 inch, winds shifting from south to west, with snow. During the day the depression disappeared to the eastward. No. VII.—This area appeared off the North Pacific coast on the 4th, attended by very heavy southeasterly gales with rain and snow in British Columbia, and southerly winds with rain in Oregon and Washington Territory, changing to snow in the northern portion of the latter as the depression passed eastward. 5th, central in the Saskatchewan valley; during the day moved eastward to the region between Lake Superior and James Bay, where it was central on the following morning. 6th, Moose Factory, 29.50, a fall of 1.12 inches, SW., cloudy; York Factory, 30.12, a rise of but 0.01 inch, wind steady from the NW. since the 4th. During the 6th, this depression moved rapidly northeastward, crossing the Labrador peninsula, and thence reaching the Atlantic ocean at the entrance to Davis' Straits, where it was probably central on the morning of the 7th. The course of the area since leaving the Province of Ontario, is quite doubtful owing to the lack of reports from this portion of North America, but the following observations reported from Godthaab indicate the approach of the depression with considerable certainty: 6th, 29.67, NW., force 2, cloudy; 7th, 29.06, NE., force 6, fair; 8th, 29.15, NNE., force 4. The pressure at Godthaab remained very low from the 1st to the 12th of the month, owing to the frequent passage of areas of barometric minima northeastward between Greenland and Iceland. The atmospheric equilibrium had not time to recover before the appearance of another area of disturbance, thus rendering it difficult to mark the interval showing the particular effect of each separate depression. During the 7th this depression probably moved northeastward and combined with area No. V, then central over the ocean west of Iceland. No. VIII.—The approach of this depression on the North Pacific coast followed closely the disappearance of area No. VII. On the 6th the winds in British Columbia shifted rapidly from SW. to NE. and N., accompanied by remarkably heavy snow, at some places reaching a depth of 10 feet, causing considerable loss of property, and interrupting all communication. Throughout Oregon and Washington Territory, southerly winds with rain, changing to snow in the former, prevailed. 7th, lowest barometer at Olympia, 29.13, or 0.82 inch below the normal. The winds increased from brisk to high, accompanied by heavy precipitation. 8th, depression central in western Dakota; Virginia City, Mont., 29.13, a fall of 0.43 inch, SW., clear; Fort Buford, 29.25, a fall of 0.61 inch, calm, cloudy. During the day the depression passed southeastward into Minnesota, being central on the 9th in western Wisconsin; LaCrosse, 29.45, a fall of 0.53 inch, W., light rain; Madison, Wis., 29.40, a fall of 0.60 inch, S., dense fog; Marquette, 29.48, a fall of 0.57 inch, SE., light rain. The depression moved rapidly northeastward during the day and by the morning of the 10th became central in the Lower St. Lawrence valley; Farther Point, 29.65, a fall of 0.79 inch, NE., threatening; Chatham, 29.83, a fall of 0.81 inch, calm, foggy; threatening weather and rain, with southeasterly winds and falling barometer, prevailed throughout the Canadian Maritime Provinces. 11th, depression central off the Banks of Newfoundland; St. Johns, N. F., 29.83, a fall of 0.73 inch, W., fair. Throughout the Canadian Maritime Provinces the winds shifted to west and northwest, with clear or fair weather and rapidly rising barometer. The depression now changed its course to the southeast and moved very slowly towards the Azores. Its dilatory movement, as indicated upon the chart, was probably due to the persistent high pressures which prevailed off the coasts of France and Spain, and continued without relief until the 21st. From the 2d to the 19th the pressure over the Atlantic in the vicinity of the Bermudas remained very high, ranging from 30.30 to 30.60. 12th, in $50^{\circ} N.$, $40^{\circ} W.$, 29.29, NE., force 4, fair; in $43^{\circ} N.$, $57^{\circ} 36' W.$, N., stormy; in $41^{\circ} 15' N.$, $30^{\circ} 20' W.$, 29.81 NW., force 2, fair. 13th, in $50^{\circ} 26' N.$, $37^{\circ} W.$, NE., moderate to high gales; in $41^{\circ} 55' N.$, $28^{\circ} 40' W.$, 29.71, SSE., force 6, rain; in $48^{\circ} 40' N.$, $47^{\circ} 30' W.$, 29.95, NNE., force 5, fair; Ponta Delgado, 29.99, a fall of 0.27 inch, wind shifted from N. 2 miles per hour to SSW. 20 miles. 14th, in $43^{\circ} 55' N.$, $26^{\circ} 25' W.$, 29.88, SE., force 5, light rain; north-easterly gales prevailed in the vicinity of $50^{\circ} N.$, $40^{\circ} W.$; in $48^{\circ} 20' N.$, $51^{\circ} 30' W.$, 29.71, S. snow;

Ponta Delgado, 29.99, S. 41 miles, cloudy. 15th, in 44° 45' N., 56° W., NW., stormy, very high sea, extremely cold; in 47° 16' N., 52° 40' W., 29.86, NNE., force 5, cloudy; Ponta Delgado, 29.93, S. 28 miles, cloudy. 16th, in 35° 10' N., 46° 45' W., 29.92, NW., force 6, cloudy; in 46° 35' N., 22° 10' W., 29.91 E., force 5, cloudy; in 40° 52' N., 20° 29' W., 29.99, S., force 4, light rain; Ponta Delgado, 29.87, SW. 18 miles, partly cloudy. 17th, in 36° N., 43° 05' W., 29.92, NW., force 6, cloudy; in 47° 30' N., 21° 30' W., 29.75, E., force 6, rain; in 38° 50' N., 24° 42' W., 29.68, SSW., force 4, cloudy, Ponta Delgado, 29.62, S. 27 miles, light rain. 18th, in 36° 10' N., 39° 25' W., 29.69, NW., force 7, severe squalls; in 48° 50' N., 21° 30' W., 29.79, E., force 8, cloudy; in 49° 51' N., 41° 49' W., 29.84, N., force 5, cloudy; in 37° 18' N., 28° 04' W., 29.54, W., force 6, high sea, cloudy; Ponta Delgado, 29.60, SW. 35 miles, partly cloudy; 19th, in 35° 20' N., 36° 30' W., 29.68, NW., force 6, light showers; in 48° 25' N., 22° 25' W., 29.80 E., force 7, cloudy; in 45° 15' N., 17° 25' W., 29.68, E., force 6, cloudy; in 35° 16' N., 31° 26' W., 29.45, NW., force 7, high cross sea, heavy rain; Ponta Delgado, 29.39, SSW. 11 miles, partly cloudy. 20th, in 35° 55' N., 33° 35' W., 29.62, NW., force 4, cloudy; in 47° 25' N., 22° 30' W., 29.62, ENE., force 6, rain; in 45° 15' N., 21° W., 29.58, ESE., force 4, cloudy; Ponta Delgado, 29.38, W. 1 mile, fair; Funchal, 29.84, a fall of 0.03 inch, WSW., cloudy. 21st, in 48° 05' N., 22° 10' W., 29.92, ESE., force 3, cloudy; in 45° 10' N., 24° 05' W., 29.84, E., force 4, light rain; in 36° 50' N., 30° 40' W., 29.80, NNW., force 5, cloudy; in 28° N., 15° 30' W., 29.92, SSE., force 3; Ponta Delgado, 29.59, calm; Funchal, 29.82, SSW. cloudy. 22d, in 37° 15' N., 28° 50' W., 29.97, NE., force 4, cloudy; in 28° N., 15° 30' W., 29.92, SSE., force 3; Ponta Delgado, 29.90, NE. 4 miles, light rain; Funchal, 29.84, WSW., cloudy. 23d, Ponta Delgado, 30.12, NE. 3 miles, fair; Funchal, 29.95, SW., fair. 24th, Ponta Delgado, 30.30, NE. 10 miles, fair; Funchal, 30.08, SW., clear. During the 22d and 23d the depression slowly disappeared off the north-western coast of Africa. No. IX.—The manner of approach of this depression on the North Pacific coast resembled that of the previous areas, Nos. V, VII and VIII, but proved to be by far the most severe. During the 9th, while the depression was central off the Oregon coast, violent southeast to southwest gales with tremendous sea were experienced and the barometer reached a minimum of 28.20. As the depression passed eastward over Oregon the barometer fell below 29.00, and wind velocities of from 50 to 80 miles per hour were recorded. In this state the destruction of property was very great, the loss being variously estimated at from \$200,000 to \$400,000. North of the storm centre, in British Columbia, Washington Territory and Montana, northerly gales with heavy snow prevailed, while to the southward, in Idaho and the northern portions of California and Nevada, southerly gales with rain prevailed. The fall of snow accompanying this storm was, in many instances reported to be the heaviest ever known. 10th, depression central in western Dakota; Ft. Buford, Dak., 28.89, a fall of 1.13 inches, calm, cloudy; Bismarck, 29.14, a fall of 0.90 inch, SE., cloudy; North Platte, 29.15, a fall of 0.59 inch, SE., clear. 11th, central over Lake Superior; Marquette, 29.37, a fall of 0.85 inch, S., light rain; Escanaba, 29.38, a fall of 0.88 inch, S., cloudy; York Factory, 29.28, a fall of 0.77 inch, W., snow; Moose Factory, 29.76, a fall of 0.52 inch, S., cloudy. 12th, probably central east of James Bay, disappearing during the day to the eastward, possibly combining with area No. VII. No. X.—Following the passage of area No. IX eastward over the Lake Region, this depression formed over Texas as the northerly winds of an approaching high area swept southward. 12th, depression central in Mississippi, with slight energy and during the day passed rapidly northeastward over Tennessee and the Ohio Valley to the Atlantic. 13th, central over the ocean east of the Middle Atlantic coast; in 40° 23' N., 70° 50' W., heavy NE. gales. During the 14th the depression probably merged with area No. VII, then central in about 45° N., 35° W.; the rapid movement of this area, together with its slight energy, was probably due to the swift advance from the Northwest of an area of high pressure, 30.40, which, by the morning of the 14th, embraced almost the entire Atlantic coast. No. XII.—This depression appeared off the coast of British Columbia on the 12th. Southeasterly winds increasing to gales, with heavy snow prevailed throughout that territory. Southerly winds with rain, changing to snow prevailed in Oregon and Washington Territory. At New Westminster the barometer fell to 29.36. 13th, depression central in Montana; Virginia City, 29.44, a fall of 0.36 inch, SW., cloudy. Heavy gales accompanied this depression in the Rocky Mountain regions; Fort Fetterman, Wyo. Ter., W. 40 to 59 miles per hour; Cheyenne, W., 42; Fort Custer, Mont., SW., 28; Pike's Peak, NW., 50. 14th, depression central north of Lake Superior; Marquette, 29.53, a fall of 0.95 inch, SW., clear; Moose Factory, 29.66, a fall of 0.76 inch, S., cloudy; York Factory, 29.88, barometer stationary, S., snow. During the day the depression disappeared north of Canada. No. XIII.—This depression probably entered the coast of British Columbia early on the morning of the 14th, as heavy southeasterly gales with snow were reported from the southern portion of that territory. 15th, depression central in the Saskatchewan valley accompanied by southerly winds and rain or snow southward over Dakota and Montana; Ft. Buford, 29.16, a fall of 1.02 inches, SW., cloudy; Ft. Garry, 29.60, a fall of 0.66 inch, S., hazy. 16th, depression central with diminished energy in northern Minnesota; St. Paul, 29.71, a fall of 0.35 inch, SE., cloudy. During the day the depression moved slowly northeastward between Lake Superior and James Bay, being central on the 17th north of Lake Huron; Alpena, 29.70, a fall of 0.10 inch, SE., light fog; Marquette, 29.68, a fall of 0.08

inch, NW., light snow. The course of the depression now changed to the southeast, and by the morning of the 18th it was central in New York. Throughout the St. Lawrence Valley, north to west winds with threatening weather and rain prevailed; pressure generally below 29.90. During the day the depression passed eastward off the New England coast followed by winds shifting to northwest with clear or clearing weather, but slowly rising barometer. 19th, depression central south of Nova Scotia, accompanied in the Canadian Maritime Provinces by brisk to high northerly winds, with rain, sleet and snow. Little Glace Bay, N. S., 29.41, a fall of 0.58 inch, calm, rain; Halifax, N. S., 29.42, a fall of 0.60 inch, N., heavy snow; in 40° 28' N., 60° 50' W., 29.41, SW., force 6, light rain; in 41° 11' N., 66° 59' W., 29.67, NNE., force 5, cloudy, heavy rain in past 24 hours. During the 20th and 21st the depression remained about stationary south of Newfoundland. Lack of sufficient ocean data on these two dates renders the movement of the area as charted, somewhat uncertain. 22nd, depression central off the Banks of Newfoundland; St. John's, 29.75, a fall of 0.51 inch, S., cloudy; in 45° 53' N., 52° W., 29.53, W., force 5, rain; in 42° 49' N., 53° 18' W., 29.90, NW., force 2, cloudy, 12 hours rain in past 24 hours. During this day and the following, the depression passed northeastward to near parallel 60° N., where on the 24th it was central. The following observations were reported from Stykkisholm, Iceland, during the approach and passage of the depression: 24th, 29.48, a fall of 0.62 inch, S., cloudy; 25th, 29.04, SW., snow; 26th, 28.71, W., snow; 27th, 28.84, SW., snow; 28th, 28.81, SW., snow; 29th, 29.19, W., snow. From the 25th to the 28th the depression appeared to remain about stationary in the vicinity of Iceland, owing perhaps to the exceedingly high pressures, 30.30 to 30.60, over central and northern Europe. The following observations were reported from Godthaab: 24th, 29.60, ENE., cloudy; 25th, 29.24, N., cloudy; 26th, 29.53, N., snow; 27th, 29.76, ENE., fair. 29th, depression central off the northwestern coast of Norway; Tromsø, 28.81, a fall of 0.51 inch, SW., cloudy; Bronø, 29.42, a fall of 0.25 inch, SW., cloudy; Haparanda, 29.32, a fall of 0.29 inch, W., cloudy. During this day and the following, the depression disappeared north of Lapland. No. XIV.—This depression probably entered British Columbia from the Pacific ocean during the 15th, but from the lack of sufficient reports its course cannot be clearly charted. 17th, central in the Saskatchewan valley: Ft. Buford, Dak., 29.33, a fall of 0.09 inch, S., fair; Ft. Garry, 29.83, a rise of 0.03 inch, SE., cloudy. 18th, central in northern Minnesota, lowest barometer (29.55) still at Ft. Buford, wind shifted to W. Owing to the rapid advance of a high pressure area (30.40) from the Saskatchewan valley, and the existence of another high area (30.25) in the Eastern Gulf, the depression on the 19th formed a barometric trough reaching from the Lower Lakes southwestward to New Mexico. During the day this elongated area contracted and became central as a small depression in the Ohio valley on the 20th, lowest barometer at Indianapolis, 29.55, a fall of 0.33 inch, W., threatening. By morning of the 21st the depression had passed off the Middle Atlantic coast, and was central south of Nova Scotia. Yarmouth, 29.39, a fall of 0.57 inch, SE., cloudy; St. John, N. B., 29.55, a fall of 0.41 inch, NE., snow; Halifax, 29.64, a fall of 0.29 inch, E., heavy rain; in 41° 26' N., 60° 53' W., 29.72, SSE., force 6; Eastport, Me., 29.49, a fall of 0.43 inch, NE., sleet; Portland, Me., 29.62, a fall of 0.27 inch, N., snow. During the day the depression passed northeastward and combined with area No. XIII, then central off the Banks of Newfoundland. No. XIX.—This depression appeared off the coast of British Columbia on the 24th, and passed rapidly eastward over that territory, and thence southeastward to Montana, where it was central on the morning of the 25th. Virginia City, 29.09, a fall of 0.37 inch, SW., threatening; Ft. Buford, 29.03, a fall of 0.70 inch, calm, cloudy; Bismarck, 29.42, a fall of 0.50 inch, S., cloudy. 26th, depression central in northern Minnesota; Duluth, 29.36, a fall of 0.48 inch, calm, cloudy; St. Paul, 29.38, a fall of 0.38 inch, S., cloudy. During the day the depression disappeared over northern Canada. No. XX.—This depression probably of cyclonic origin, first appeared over the Caribbean Sea, northeast of the Yucatan Peninsula on the 25th. Along the northern and eastern Gulf coasts the pressure fell steadily from the 23d, winds shifting to northeast with occasional rain. Throughout the West Indies, north of parallel 20° and west of the 70th meridian, the pressure fell quite generally on the 25th, winds shifting from south to east with occasional rain. In 21° 50' N., 74° 05' W., 29.89, a fall of 0.14 inch, in past 24 hours, E., force 4, showery; Nassau, Bahamas, 29.94, a fall of 0.06 inch, SE., cloudy; Havana, Cuba, 29.87, a fall of 0.06 inch, SSE., clear; Key West, 29.88, a fall of 0.05 inch, S fair; Punta Rassa, 29.85, a fall of 0.11 inch, NE., foggy. 26th, Key West, 29.79, S., threatening; Havana, 29.80, S., rain; Punta Rassa, 29.73, SE., light rain. During the day the depression passed northeastward over Florida, and by the following morning was central off the South Carolina coast. 27th, Charleston, 29.69, a fall of 0.25 inch, NE., cloudy; Wilmington, 29.77, a fall of 0.24 inch, E., light rain, 2.35 inches in past 24 hours. Along the North Carolina coast the winds shifted to northeasterly with heavy rain. 28th, depression central near 40° N., 70° W. Along the Middle Atlantic coast the winds shifted from NE. to W. and NW., with falling barometer and rain. In 38° 18' N., 73° 28' W., 29.75, WNW., force 3, foggy; in 34° 29' N., 72° 56' W., 29.95, S., force 3, light rain. This storm developed but slight energy along the Atlantic coast, or even over the ocean, so far as can be judged from reports at hand. During the 28th the depression combined with area No. XXII, then central off the Banks of Newfoundland. No. XXII.—As area No. XIX passed eastward over the Lake Region on the 26th, a slight depression formed to the southward in Texas,

which, by the following morning had gradually developed into an extensive barometric trough, reaching from Michigan southwestward to New Mexico. During the day the depression moved rapidly northeastward over the Ohio Valley and Lower Lake Region, and by the morning of the 28th was central in northern New England. On this day area No. XX being central over the ocean east of the Middle Atlantic coast, the two depressions were in about the same meridian and formed a barometric trough extending south from Labrador to about 35° N.; Chatham, 29.69, a fall of 0.51 inch, S., light rain; Dalhousie, N. B., 29.67, a fall of 0.49 inch, W. cloudy. Rain, with a fall in pressure of from 0.20 to 0.50 inch generally prevailed throughout the Canadian Maritime Provinces. 29th, after combining with area No. XX the depression became central off the Banks of Newfoundland, followed over the Maritime Provinces by winds shifting to northwesterly with clear and clearing weather. St Johns, N. F., 29.56, a fall of 0.63 inch, SW., cloudy; in $48^{\circ} 15'$ N., $43^{\circ} 19'$ W., 29.15, WSW., force 7, very heavy westerly sea, light rain; in $40^{\circ} 35'$ N., $48^{\circ} 40'$ W., 29.83, SW., force 9, very heavy westerly sea. During the day the depression moved northeastward between the parallels of 50° and 60° N., and on the morning of the 30th was central with greatly increased energy in about 60° N., 30° W. The central area of low was inclosed by the isobar of 28.40, while the isobar of 29.80 passed southeastward from the northeastern coast of Labrador to about 37° N., 40° W., and thence northeastward to the White Sea, embracing 30° of latitude and about 90° of longitude. Over the Canadian Maritime Provinces the pressure rose rapidly from 0.30 to 0.70 inch with northwesterly winds; between the meridians of 20° and 40° W., and near the parallel of 50° N. the barometer fell to 29.20, with westerly winds; over the northwestern portion of the British Isles the pressure fell from 0.10 to 0.25 inch, with southwesterly winds and rain. During the approach and passage of the depression the following observations were reported from Stykkisholm, Iceland: 29th, 29.19, W., force 6, snow; 30th, 28.34, SE., force 10, rain; 31st, 28.67, SE., force 4, snow. The following observations were reported from Godthaab, Greenland: 28th, 29.45, ENE., force 4, cloudy; 29th, 28.88, NNE., force 4, fair; 30th, 28.91, NE., force 8, snow; 31st, 29.01, NNE., force 4, fair. No. III.—Although this area, as indicated upon the chart, first appeared over the ocean, it cannot be considered as developing there, it being but a continuation of area No. XXX of the December, 1879, chart. Central morning of the 1st in about 60° N., 25° W., the depression moved rapidly northeastward to the Norwegian coast. On this day the central area of low was inclosed within the isobar of 28.40, while the isobar of 29.80 inclosed the whole of northern Europe, and thence westward over the ocean north of parallel 50° N. to the meridian of 40° W. The pressure over the British Isles ranged from 29.00 to 29.90, with southwesterly winds increasing to gales, accompanied by squalls of rain or snow, with occasional hail. The following observations were reported from Stykkisholm, Iceland, during the approach and passage of the depression: 1st, 28.39, NE., force 6, snow; 2nd, 29.21, N., force 8, snow; 3rd, 29.10, SE., force 8, cloudy. The following observations were reported from Godthaab, Greenland: 1st, 29.15, ENE., force 2, cloudy; 2nd, 29.41, ENE., force 4, cloudy; 3rd, 29.17, NNE., force 4, cloudy. 2nd, depression central north of the Shetland Islands; Thorshavn, 28.62, W., force 8, rain and hail; North Unst, 28.97, W., force 8, cloudy; Bergen, 29.30, SW. 34 miles per hour, sleeting; Brono, 28.79, SW. 27 miles, cloudy; Christiana, 29.30, WSW., cloudy; Tromso, 28.71, SW., cloudy; Haparanda, 29.11, S., force 6, snow; Umea, 29.07, S., force 8, cloudy; Hernosand, 29.10, S., force 6, cloudy. 3rd, depression central over northern Sweden; Haparanda, 28.86, SW., force 2, cloudy; Umea, 28.98, SW., force 2, fair; Hernosand, 29.02, SSW., force 2, fair; Stockholm, 29.24, WSW., force 4, light rain; Tromso, 28.69, NW., cloudy; Bergen, 29.61, NNW. 28 miles, sleet; Brono, 29.07, NNW. 27 miles, rain; Archangel, 29.18, a fall of 0.66 inch, SSE., cloudy. 4th, depression slowly filling up over Lapland with clearing weather to the westward in Scandinavia. During the 5th and 6th the depression gradually disappeared over northern Russia, accompanied by southerly winds and cloudy weather throughout the central and northern portions of that country. Concerning the storms over Europe the following detailed descriptions are given: No. IV.—On the 1st the pressure over the central portion of southern Russia was generally below 29.80, the lowest barometer being reported from Nikolaiev, 29.67, a fall of 0.43 inch, calm, foggy; Kieff, 29.72, a fall of 0.14 inch, NW., cloudy; Lugan, 29.84, a rise of 0.04 inch, SE., cloudy. 2nd, depression moved slowly southeastward; Kieff, 29.72, N., cloudy; Nikolaiev, 30.12, a rise of 0.45 inch, NNW., cloudy; Lugan, 29.87, calm, cloudy. During the day the depression passed southeastward over the Black Sea and on the 3rd disappeared over Turkey; Beirut, 29.82, a fall of 0.33 inch, wind shifted from SSW. to WNW., light rain during the past 8 hours. No. XI.—This depression first appeared off the northwestern coast of Norway on the 12th, following closely the disappearance of No. V, to the eastward; Tromso, 29.97, NE., cloudy; Brono, 30.21, WSW., 18 miles per hour, rain and snow. 13th, depression central over Lapland with greatly increased energy; Tromso, 29.21, NNE., cloudy; Brono, 29.65, NW. 22 miles, cloudy; Haparanda, 29.40, W., fair; Archangel, 29.35, W., cloudy. During the day the depression changed its course to the southward, and by the morning of the 14th was central near the Gulf of Finland; St. Petersburg, 29.20, a fall of 0.55 inch, S., cloudy; Dorpat, 29.27, a fall of 0.63 inch, SW., fair; Archangel, 29.22, E., cloudy; Haparanda, 29.38, N., fair; Umea, 29.43, N., fair. During the day the depression passed slowly southeastward over the Gulf of Finland, and by the

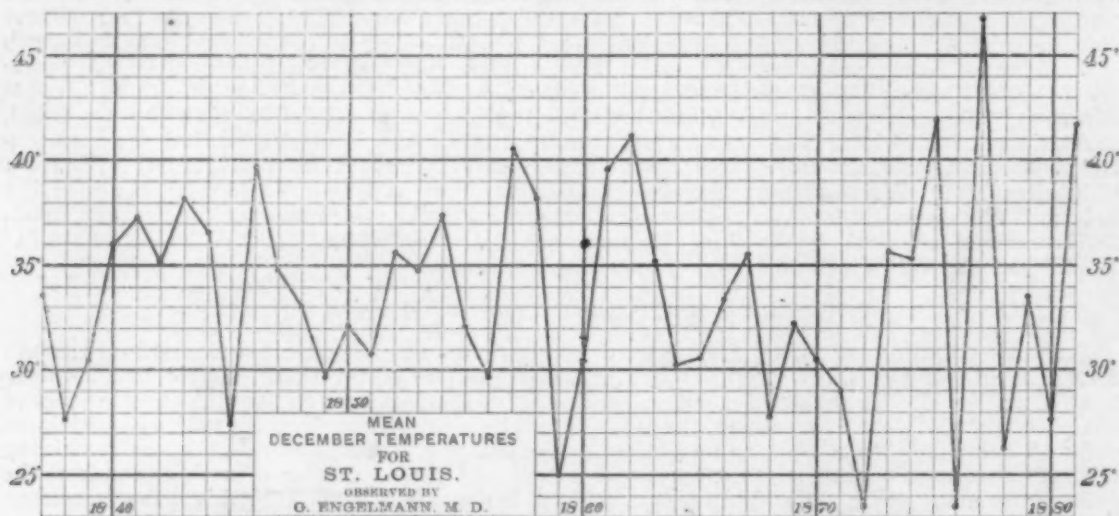
morning of the 15th was central north of Moscow, barometer 29.56, S., fair; St. Petersburg, 29.26, NE., snow; Dorpat, 29.34, WNW., light snow; Archangel, 29.39, ENE., fair; Kasan, 29.87, SSE., snow; Krotkovo, 30.04, S., snow. 16th, depression about stationary, probably owing to the high pressures over southeastern Russia, western Siberia and in Toorkistan. St. Petersburg, 29.59, NNW., snow; Dorpat, 29.65, W., light snow; Moscow, 29.73, SW., cloudy; Archangel, 29.44, SE., cloudy; Kasan, 29.97, S., cloudy; Krotkovo, 30.23, S., cloudy. 17th, depression still about stationary and slowly filling up; pressure rapidly increasing over western Russia. Ekaterinburg, 30.39, calm; Krotkovo, 30.27, S., cloudy; Kasan, 30.13, S., snow; Archangel, 29.74, ESE., cloudy; St. Petersburg, 29.74, SW., fair; Dorpat, 29.76, SE., light snow; Moscow, 29.92, S., cloudy. By morning of the 18th, the depression had entirely filled up over northern Russia, the isobar of 30.20 replacing that of 29.80 on the previous day. No. XV.—This depression appeared suddenly off the northwestern coast of Norway on the morning of the 19th. Tromso, 29.48, a fall of 0.50 inch, NE., cloudy; Haparanda, 29.88, a fall of 0.18 inch, SE., snow; Brono, 29.71, a fall of 0.44 inch, SW. 27 miles per hour, cloudy. Over the southern portion of Scandinavia the barometer ranged from 30.15 to 30.35, with variable winds. During the day the depression moved southeastward and by morning of the 20th was central over the Baltic. Wisby, 29.80, a fall of 0.31 inch, NNW., snow; Umea, 29.82, a fall of 0.18 inch, NE., cloudy; southerly winds with cloudy and partly cloudy weather and slowly falling barometer prevailed over northwestern Russia. Along the Norwegian coast the pressure ranged from 30.10 to 30.21, with northwesterly winds. During the day the depression passed slowly southeastward over the Baltic, and on the 21st disappeared under the influence of a high pressure area in western Russia. No. XVII.—The approach of this depression off the northwestern coast of Norway closely resembled in its suddenness that of area No. XV. 21st, Tromso, 29.53, a fall of 0.44 inch, SW., cloudy; Brono, 29.85, a fall of 0.29 inch, SW., cloudy; Haparanda, 30.13, a rise of 0.23 inch, SE., cloudy; Archangel, 30.32, a rise of 0.18 inch, ESE., fair. 22nd, depression central near the White sea; Archangel, 29.92, a fall of 0.40 inch, ESE., cloudy; St. Petersburg, 30.02, a fall of 0.21 inch, NW., clear; Moscow, 29.85, a fall of 0.18 inch, E., cloudy; Kasan, 29.96, a fall of 0.30 inch. During the 23d, the depression disappeared over eastern Russia under the influence of a high pressure area, 30.40. No. XVIII.—This depression first appeared north of Iceland on the 22nd, as indicated by the barometer at Stykkisholm, which during the past 24 hours had fallen 0.63 inch, wind shifted from southeast to southwest. 23rd, depression central off the northwestern coast of Norway. Stykkisholm, 30.10, a rise of 0.39 inch, W., force 6, cloudy; Tromso, 28.98, a fall of 0.99 inch, SW. 34 miles per hour, cloudy; Brono, 29.56, a fall of 0.65 inch, SW. 36 miles, cloudy; Haparanda, 29.68, a fall of 0.42 inch, S., fair; Umea, 29.80, a fall of 0.37 inch, SW., cloudy. 24th, depression central over Lapland, followed to the westward in Norway by winds shifting to northwesterly with rising barometer and snow; Haparanda, 29.40, NW., clear; Umea, 29.63, NW., clear; St. Petersburg, 29.55, a fall of 0.52 inch, SSE., light snow; Dorpat, 29.60, a fall of 0.56 inch, WSW., snow; Archangel, 29.57, a fall of 0.29 inch, SE., cloudy; Moscow, 30.09, a fall of 0.14 inch, S., fair. 25th, depression central in northern Russia; lowest barometer at Kasan, 29.65, a fall of 0.46 inch, W., clear; Krotkovo, 29.80, a fall of 0.29 inch, W., clear; Moscow, 29.96, a fall of 0.13 inch, S., fair; Archangel, 29.89, a rise of 0.32 inch, SE., cloudy; Ekaterinburg, 29.94, a fall of 0.34 inch, ENE., cloudy. 26th, depression disappeared in western Siberia under the influence of a high pressure area, 30.30. Concerning storms off the Asiatic coast, but one has been traced for the present month. There may have been others, and doubtless were, but insufficient data prevents the charting of any additional tracks. No. VI.—This depression first appeared south of the Island of Kinsin on the 2nd; Nagasaki, 29.94, a fall of 0.12 inch, NNE., clear, 6.35 m.m. rainfall in past 24 hours; Hiroshima, 29.95, a fall of 0.08 inch, NNE., cloudy, 6.91 m.m. rainfall in past 24 hours; Wakayama, 29.83, a fall of 0.21 inch, raining, 14.91 m.m. rainfall in past 24 hours; Tokei, 29.95, a rise of 0.05 inch, N., raining, 17.78 m.m. rainfall in past 24 hours. 3rd, depression central southeast of the Island of Nippon; Tokei, 29.68, NW., foggy; Wakayama, 29.87, NW., fair; Hiroshima, 29.91, WNW., clear; Nagasaki, 30.01, W., fair; in 32° 04' N., 133° 30' E., force 3 to 5, high NW. sea, hailing. 4th, depression disappeared to the eastward over the ocean; Tokei, 29.71, a rise of 0.03 inch, NW., clear; Wakayama, 29.94, a rise of 0.07 inch, W., raining; in 31° N., 130° 53' E., WNW., force 4, high westerly sea, raining.

TEMPERATURE OF THE AIR.

The distribution of mean atmospheric temperature over the United States and Canada for the month of December, 1881, is exhibited by lines of equal thermometric mean values upon chart No. II. The table of mean and comparative temperatures in the right-hand corner of the chart shows, in the first column, the average for the month throughout the various districts, as deduced principally from observations taken at Signal Service stations. In the two remaining columns are shown the means for the present month, and the departures of such means from the average for many years. The mean temperature of the month is remarkably high, the thermometric values being everywhere above the normal, except in California. The region of greatest excess embraces the Upper Mississippi and Missouri Valleys, Minnesota and the Lakes, the departures from the normal ranging from 9°.1 to 13°.1. The small area of deficiency for the present month

occupies central California, with a departure from the normal of $1^{\circ}.2$. Southern California reports a normal condition. As a means of interesting comparison, the following maximum departures from the normal are given for each year since 1873, together with the corresponding districts: 1874, $+5^{\circ}.2$ Lower Missouri Valley and $-4^{\circ}.7$ St. Lawrence Valley; 1875, $+10^{\circ}.9$ Lower Missouri Valley, $+10^{\circ}.2$ Upper Mississippi Valley and $+9^{\circ}.0$ Ohio Valley, Tennessee, and Minnesota; 1876, $-8^{\circ}.7$ Upper Mississippi Valley and $-8^{\circ}.0$ Ohio Valley and Tennessee; 1877, $+20^{\circ}.2$ Minnesota and $+17^{\circ}.1$ Upper Mississippi Valley; 1878, $-4^{\circ}.4$ Lower Missouri Valley and $-4^{\circ}.2$ Ohio Valley and Tennessee; 1879, $-18^{\circ}.5$ Red River of the North Valley and $-12^{\circ}.4$ Missouri Valley; 1880, $-6^{\circ}.9$ Missouri Valley and $-6^{\circ}.0$ Ohio Valley and Tennessee.

Deviations from Mean Temperatures.—Under this heading departures exhibited by reports from the regular Signal Service stations are shown in the table of comparative temperatures on the right-hand side of chart No. II. The following items of importance in connection with this subject are reported by Voluntary Observers: *Illinois*: Riley, mean temperature $9^{\circ}.2$ above the mean of the past 19 years; higher mean temperatures occurred in 1875 and 1877. Mean temperature for the year 1881, $45^{\circ}.6$ or $0^{\circ}.7$ above the annual mean for the past 18 years; the years 1863, 1870, 1877 and 1880 were warmer, while the mean of 1871 coincided with that of the present year; maximum temperature of the year, 97° , August 5th; minimum -25° , January 14th, giving a yearly range of 122° . *Kansas*: Lawrence, the following interesting summary is furnished by Prof. F. H. Snow of the State University: Mean temperature $11^{\circ}.4$ above the average of the past 13 years; with the exception of December 1877, December 1881 was the warmest since 1868. Mean temperature for the year 1881, $54^{\circ}.65$ or $1^{\circ}.31$ above the annual mean of the past 13 years; maximum temperature of the year 104° occurred on August 11th and 25th; minimum -8° occurred on January 9th, giving a yearly range of 112° . Mean temperature of the year at 7 a. m., $48^{\circ}.87$; 2 p. m., $63^{\circ}.52$; 9 p. m., $53^{\circ}.12$. Mean temperature of the winter months, $29^{\circ}.16$ or $0^{\circ}.92$ below the average of the past 13 years; of the spring months, $53^{\circ}.27$ or $0^{\circ}.74$ above the average; of the summer months, $79^{\circ}.41$ or $3^{\circ}.02$ above the average, and of the autumn months, $56^{\circ}.75$ or $3^{\circ}.86$ above the average. The coldest month of the year was January, mean temperature $21^{\circ}.60$; the warmest month of the year was August, mean temperature $81^{\circ}.23$. The coldest week was from January 8th to 14th, mean temperature $14^{\circ}.45$; warmest week was from July 5th to 11th, mean temperature $85^{\circ}.09$. The coldest day was January 9th, mean temperature $-1^{\circ}.5$; warmest day was August 17th, mean temperature $89^{\circ}.7$. The temperature fell below zero 6 times and reached or exceeded 100° 14 times during the year. Yates Centre, mean temperature $12^{\circ}.3$ above the average of the past 2 years. Wellington, mean temperature $38^{\circ}.4$ or $5^{\circ}.8$ above the mean of the past 3 years. *Maine*: Gardiner, mean temperature $31^{\circ}.61$ or $9^{\circ}.31$ above the mean of the past 45 years; the warmest December previous to that of 1881 occurred in 1877, mean $29^{\circ}.50$; next warmest occurred 1847, mean $28^{\circ}.65$. During the past 45 years there has been but three Decembers when the minimum temperature was above zero. *Maryland*: Fallston, mean temperature $39^{\circ}.94$ or $7^{\circ}.38$ above the average of the past 10 years. Sandy Springs, mean temperature considerably above the average of the past 15 years. *Michigan*: Thornville, mean temperature considerably above the average. *Missouri*: St. Louis,—The following report is furnished by Mr. B. D. Kribben: mean temperature, $41^{\circ}.07$ or $7^{\circ}.87$ above the normal. Mean temperature for the year, $56^{\circ}.06$ or $0^{\circ}.66$ above the normal. Maximum temperature for the year, $104^{\circ}.9$ occurred on August 12th;



minimum temperature, $9^{\circ}.4$, on January 14th. St. Louis, Missouri Weather Service reports, mean temperature $41^{\circ}.70$ or $8^{\circ}.50$ above the average of the past 44 years; the mean temperature of

December, 1881, has been exceeded but twice in the past 44 years, viz.: in 1875, mean, 41°.9, and in 1877, mean 46°.7. *Montana*: Blackfeet Agency, mean temperature considerably above the average; month unusually mild. *New Hampshire*: Contoocookville, mean temperature, 33°.8, or nearly 10° above the average of the past 10 years; in some parts of this portion of the State it is reported to be the warmest December for the past 25 years. *New Jersey*: Moorestown, mean temperature considerably above the average of the past 18 years and not exceeded or even equalled by any December during that period. Freehold, mean temperature considerably above the average of the past 7 years. *New York*: Waterburg, mean temperature 34°.5 or 8°.1 above the mean of the past 10 years; with the exception of December 1881, that of 1877 was the warmest during that period. Ardenia, mean temperature considerably above the average; month unusually mild. North Volney, mean temperature 33°.7 or 8°.9 above the mean of the past 13 years; with the exception of December 1881, that of 1877, (mean 31°.63) was the warmest during that period; the coldest occurred in 1876, mean 18°.02. The mean temperature of the year at 7 a. m., was 42°.41; at 2 p. m., 53°.40 and at 9 p. m., 44°.54. Yearly range of temperature 112°. The average of the mean annual temperatures of the past 12 years is 45°.31; highest annual mean 47°.74 occurred in 1878; lowest, 41°.61 occurred 1875. *Palermo*, mean temperature considerably above the average of the past 28 years. Mean temperature of the year 44°.40 or 0°.60 below the mean of the past 20 years. Hector, mean temperature considerably above the average; month unusually warm and open. *Ohio*: Cleveland, mean temperature 38°.1 or 7°.36 above the mean of the past 27 years; highest monthly mean during that period 40°.51, occurred in 1877; lowest 20°.99 occurred in 1876. *Pennsylvania*: New Castle, mean temperature 37°.9 or 7°.78 above the mean of the past 16 years. Dyberry, mean temperature considerably above the average of the past 20 years, and warmer

Table of Maximum and Minimum Temperatures for December, 1881.

State or Territory.	Signal Service.			U. S. Army Post Surgeons or Voluntary Observers.			State or Territory.	Signal Service.			U. S. Army Post Surgeons or Voluntary Observers.		
	Station.	Max.	Min.	Station.	Max.	Min.		Station.	Max.	Min.	Station.	Max.	Min.
Alabama.....	Mobile.....	73	0	Auburn.....	0	90	Missouri.....		0	0	Oregon and St. Louis.....	0	14
Do.....	Montgomery.....		33	Texas Hill.....	85		Do.....						
Arizona.....	Florence and Tucson.....	82					Montana.....	Ft. Benton.....	67		Lincoln.....	60	6
Do.....	Fort Apache and Prescott.....		13				Do.....	New Chicago.....	-16		Genoa.....		
Arkansas.....	Little Rock.....	69	34	Mt. Ida.....	22		Nebraska.....	Omaha and North Platte.....	50	9			
California.....	Los Angeles.....	79		Indio & Poway Summit.....	82	12	Do.....	Pioche.....	65				
Do.....	Camper.....		15				Do.....	Winnemucca.....	7		Colconda.....	75	10
Colorado.....	Denver.....	67	18				Do.....				Boca.....		
Do.....	Pike's Peak.....	27	-11				New Hampshire.....	Mt. Wash'ton.....	41	-21	Contoocook's Grafton.....	62	-2
Connecticut.....	New Haven.....	58	13	Southington.....	61	8	Do.....	Sandy Hook.....	69		Ato.....	70	6
Do.....	New London.....	58					Do.....	Atlantic City.....	19		Somerville.....		
Dakota.....	Smithville.....	64		Ft. Buford.....	-25		New Mexico.....	La Mesilla.....	80		Ft. Stanton.....	70	-1
Do.....	Ft. Buford.....		-20				Do.....	Silver City.....	11				
Delaware.....	Breakwater.....	69	22				Do.....	New York.....	60		Madison Barracks.....	54	-2
Dist. Columbia.....	Washington.....	70	21	Receiving Reservoir.....	73	18	Do.....	Albany.....	11				
Do.....	Key West and Punta Rassa.....	83		Ft. Brook Tampa.....	87		Do.....	Wilmington.....	73		Weldon.....	74	12
Do.....	Pensacola.....		38	Ft. Barrancas.....	25		Do.....	Kittyhawk.....	26		Highlands.....		
Georgia.....	Savannah.....	77		Forsyth.....	78		Do.....	Cincinnati.....	65		Portsmouth.....	73	13
Do.....	Augusta.....		29				Do.....	Cleveland & Columbus.....	17		Bellefontaine.....		
Idaho.....	Boise City.....	54					Do.....	Portland.....	58		Ft. Klamath.....	50	-1
Do.....	Eagle Rock.....		-10				Do.....	Umatilla.....	21				
Illinois.....	Cairo.....	67		Elmira.....	4		Pennsylvania.....	Philadelphia.....	69		Blooming Grove & Franklin.....		10
Do.....	Champaign.....		19				Do.....	Pittsburg.....	15		Ft. Adams.....	56	14
Indiana.....	Indianapolis.....	63	14	Laconia.....	65		Rhode Island.....	Newport.....	60	15	Aiken, Columbia & Stateburg.....		28
Do.....				Wabash.....	14		Do.....	Charleston.....	76	33			
Indian Ty.....	Ft. Gibson.....	73					Tennessee.....	Memphis.....	70				
Do.....	Ft. Supply.....		18				Do.....	Knoxville.....	23				
Iowa.....	Keokuk.....	60		Nora Springs.....	-10		Do.....	Edinburg & Rio Grande.....	83		Ft. Brown.....	87	32
Do.....	Dubuque.....		8				Do.....						
Kansas.....	Dodge City.....	72	17	Independence.....	73		Do.....	El Paso and Ft. Elliott.....	18		Blue Creek & Corinne.....	50	0
Do.....	Leavenworth.....		17	Topeka.....	8		Do.....	Salt Lake City.....	49	17	Promontory.....		0
Kentucky.....	Louisville.....	67	19	Bowl'g Green.....	66	21	Do.....				Woodstock.....	62	-1
Louisiana.....	New Orleans.....	77					Utah.....				Wynneville.....		12
Do.....	Shreveport.....		31				Do.....						
Maine.....	Eastport.....	52	-6	Cornish.....	60		Do.....						
Do.....				Dexter.....	-3		Vermont.....	Burlington.....	56	4			
Maryland.....	Baltimore.....	71	24	Fallston.....	74		Do.....	Cape Henry.....	74				
Do.....				Great Falls.....	14		Do.....	Lyonsburg.....	22				
Massachusetts.....	Thatcher's Id.....	67	9	Heath.....	1		Do.....	Dayton.....	60				
Michigan.....	Detroit.....	69		Ft. Brady.....	57	-6	Do.....	Coifax and Spokane.....	10				
Do.....	Escanaba.....		8				Do.....	Morgantown.....	68	22	Helvetia.....	60	18
Minnesota.....	St. Paul.....	53		Ft. Snelling.....	62		Do.....	La Crosse.....	54	1	Neillsville.....	50	-4
Do.....	St. Vincent.....		-20				Do.....	Cheyenne.....	58	11	Forto Bridge & Washakie.....		-9
Mississippi.....	Vicksburg.....	75	33	Fayette.....	73	32	Do.....						
Missouri.....	St. Louis.....	64	15	Sedalia and Pierce City.....	70								
Do.....													

than any December during that period, except December, 1877. Wellsboro, mean temperature considerably above the average of the past 25 years. *Vermont*: Woodstock, mean temperature 30°.1 or 10°.6 above the mean of the past 14 years; lowest December mean occurred in 1872, and highest in 1877. Catawissa, mean temperature considerably above the average; month very pleasant. *Virginia*: Wytheville, mean temperature 39°.3 or 4°.5 above the mean of the past 17

years. *West Virginia:* Helvetia, mean temperature 39°.2 or 6°.31 above the mean of the past 6 years. Mean temperature for the year 50°.71 or 0°.22 below the mean of the past 6 years.

Table of Comparative Minimum Temperatures for the month of December.

State or Territory.	Minimum for December, 1881, Signal Service.		Lowest since Signal Service sta- tions were opened—3 to 10 years.			Lowest from any other source.		
	Station.	Temp.	Station.	Temp.	Year.	Place.	Temp.	Length of Record.
Alabama.....	Montgomery.....	33	Montgomery.....	0	1880	Huntsville.....	-7	9 years.
Arizona.....	Ft. Apache and Prescott.	13	Prescott.....	-18	1879	Ft. Canby.....	-25	12 "
Arkansas.....	Little Rock.....	34	Little Rock.....	0	1880	Washington.....	-6	28 "
California.....	Campos.....	15	Campos.....	7	1878	Ft. Jones.....	-17	5 "
Colorado.....	Pike's Peak.....	-11	Pike's Peak.....	-37	1878	Fort Garland.....	-30	39 "
Connecticut.....	New London.....	13	New Haven.....	-4	1880	Ft. Lyon.....	-30	20 "
Dakota.....	Ft. Buford.....	-20	Pembina.....	-49	1876	Middletown.....	-15	10 "
Delaware.....	Delaware Breakwater.....	22	Fts. Stevenson & Buford.....	-46	1879	Ft. Totten.....	-61	7 "
Dist. of Columbia.....	Washington.....	21	Delaware Breakwater.....	1	1880	Ft. Stevenson.....	-34	7 "
Florida.....	Pensacola.....	29	Delaware Breakwater.....	1	1880	Ft. Sully.....	-30	16 "
Georgia.....	Augusta.....	29	Washington.....	-13	1880	Ft. Delaware.....	9	44 "
Idaho.....	Eagle Rock.....	-10	Pensacola.....	17	1880	Dover.....	6	6 "
Illinois.....	Champaign.....	-12	Atlanta.....	1	1880	Washington.....	-10	48 "
Indiana.....	Indianapolis.....	14	Lewiston.....	-10	1879	Ft. Barrancas.....	15	52 "
Indian Territory.....	Ft. Supply.....	18	Chicago.....	-15	1880	Ft. McPherson.....	6	11 "
Iowa.....	Dubuque.....	8	Indianapolis.....	-15	1876	Ft. Hall.....	-30	10 "
Kansas.....	Dodge City and Leavenworth.....	17	Ft. Gibson.....	-9	1876	Rock Island Arsenal.....	-26	14 "
Kentucky.....	Louisville.....	19	Dubuque.....	-19	76, 79, 80	Wabash.....	-19	6 "
Louisiana.....	Shreveport.....	31	Dodge City.....	-15	1876	Ft. Sill.....	-11	10 "
Maine.....	Eastport.....	0	Louisville.....	-7	1880	Cresco.....	-28	8 "
Maryland.....	Baltimore.....	24	Shreveport.....	-10	1880	Ft. Wallace.....	-24	8 "
Massachusetts.....	Boston.....	10	Eastport.....	-30	1875	Fort Leavenworth.....	-21	50 "
Michigan.....	Escanaba.....	8	Baltimore.....	-3	1880	Newport Barracks.....	-8	28 "
Minnesota.....	St. Vincent.....	-29	Boston.....	-11	1875	Okaloosa.....	10	3 "
Mississippi.....	Vicksburg.....	33	Escanaba.....	-23	1880	Ft. Jessup.....	14	22 "
Missouri.....	St. Louis.....	15	St. Vincent.....	-42	1880	Gardiner.....	-24	45 "
Montana.....	New Chicago.....	-10	Vicksburg.....	12	1880	Emmitsburg.....	-19	7 "
Nebraska.....	Omaha and North Platte.....	9	St. Louis.....	-15	1880	Billerica.....	-20	8 "
Nevada.....	Winnemucca.....	7	Ft. Benton.....	-50	1880	New Bedford.....	-10	60 "
New Hampshire.....	Mount Washington.....	-21	North Platte.....	-27	1879	Ft. Brady.....	-41	58 "
New Jersey.....	Atlantic City.....	19	Winnemucca.....	-20	1879	Ft. Ripley.....	-40	14 "
New Mexico.....	Silver City.....	11	Mount Washington.....	-47	1876	Fayette.....	11	8 "
New York.....	Albany.....	11	Atlantic City and Barnegat.....	-7	1880	Rolla.....	-23	7 "
North Carolina.....	Kittyhawk.....	26	Santa Fe.....	-13	1879	Camp Baker.....	-53	9 "
Ohio.....	Cleveland and Columbus.....	17	Albany.....	-17	1875	Sidney Barracks.....	-37	5 "
Oregon.....	Umatilla.....	21	Charlotte.....	-5	1880	Glendale.....	-30	12 "
Pennsylvania.....	Pittsburg.....	15	Sandusky.....	-13	1880	Ft. Halleck.....	-22	12 "
Rhode Island.....	Newport.....	16	Portland.....	3	1879	Barnmouth College.....	-24	11 "
South Carolina.....	Charleston.....	33	Eric.....	-11	1880	Stratford.....	-24	11 "
Tennessee.....	Knoxville.....	23	Newport.....	-3	1875	Linden.....	-18	6 "
Texas.....	Fort Elliott.....	18	Charleston.....	13	1880	Newark.....	-11	20 "
Utah.....	Salt Lake City.....	17	Aiken.....	3	1880	Ft. Union.....	-28	30 "
Vermont.....	Burlington.....	4	Charleston.....	13	1880	Madison Barracks.....	-44	54 "
Virginia.....	Lynchburg.....	22	Knoxville.....	-5	1880	Gouverneur.....	-40	40 "
Washington T'y.....	Spokane and Colfax.....	10	Fort Elliott.....	-10	1879	Lenoir.....	-6	8 "
West Virginia.....	Morgantown.....	23	Salt Lake City.....	-10	1879	Ft. Johnson.....	9	54 "
Wisconsin.....	La Crosse.....	1	Burlington.....	-19	1879	Kenton.....	-20	3 "
Wyoming.....	Cheyenne.....	11	Ft. Whipple.....	-11	1880	College Hill.....	-10	68 "
						Eola.....	-8	7 "
						Lewisburg.....	-23	6 "
						Fleming.....	-19	6 "
						Carlisle Barracks.....	-14	34 "
						Providence.....	-12	36 "
						Aiken.....	3	7 "
						Charleston.....	20	104 "
						Clarksville.....	-4	8 "
						Camp Stockton.....	-9	15 "
						Ft. Crittenden.....	-22	3 "
						Coalville.....	-22	16 "
						Lunenburg.....	-30	20 "
						Dover.....	-34	2 "
						Fortress Monroe.....	17	56 "
						Ft. Colville.....	-22	21 "
						Ft. Townsend.....	-22	23 "
						Flemington.....	-21	2 "
						Ft. Howard.....	-36	51 "
						Ft. Fetterman.....	-36	14 "

Ranges of Temperature at Signal Service Stations.—Monthly ranges in general varied from 40° to 55° over the country east of the Rocky Mountains, and from 35° to 50° westward to the Pacific. The *smallest* ranges are: San Francisco, 20°; Key West, 22°; Lewiston, Idaho, 23°; Grand Haven, 28°; Portland, Or., 29°; Sacramento, 30°; Port Eads and Galveston, 31°; Salt Lake City, 32°. The *largest* are: New Chicago, Mont., 76°; Fort Buford, 71°; Fort Benton, 70°; Bismarck, 68°; Fort Stevenson, 64°; Smithville, Dak., 63°; Mt. Washington, 61°. The *daily* ranges varied in the different districts as follows: New England, 24° at Wood's Holl to 34° at Eastport and 35° on summit of Mt. Washington; Middle Atlantic States, 21° at Cape May to 31° at Albany and 35° at Philadelphia; South Atlantic States, 21° at Jacksonville and Charleston to 31° at Augusta, Smithville, Wilmington, and Portsmouth; Florida Peninsula, 16° at Key West to 18° at Cedar Keys and Punta Rassa; East Gulf States, 20° at New Orleans to 29° at Vicksburg; West Gulf States, 17° at Port Eads to 28° at Fort Gibson and 37° at Mason; Rio Grande Valley, 28° at Brownsville to 37° at Castroville and 45° at Uvalde; Ohio Valley and Tennessee,

19° at Champaign, to 29° at Knoxville and 30° at Nashville and Pittsburg; Lower Lake Region, 25° at Toledo to 29° at Erie and Rochester; Upper Lake Region, 16° at Grand Haven to 26° at Alpena and 33° at Duluth; Upper Mississippi Valley, 22° at Madison to 28° at Keokuk and 33° at St. Paul; Missouri Valley, 26° at Omaha to 38° at Huron and 39° at St. Vincent; Extreme Northwest, 32° at Moorhead to 40° at Bismarck and Fort Buford; Southern Slope, 28° at Henrietta to 40° at Concho and 43° at El Paso and Stockton; Middle Slope, 21° at Pike's Peak to 36° at Denver and 39° at Fort Elliott; Northern Slope, 36° at Fort Keogh to 41° at Cheyenne and 43° at North Platte; Southern Plateau, 41° at Silver City and Fort Verde to 49° at La Mesilla; Middle Plateau, 18° at Salt Lake City to 30° at Winnemucca and 36° at Pioche; Northern Plateau, 17° at Lewiston to 29° at Umatilla and 34° at Eagle Rock; South Pacific Coast Region, 30° at San Diego to 35° at Visalia and 52° at Campo; Middle Pacific Coast Region, 10° at San Francisco to 21° at Sacramento and 30° at Red Bluff; North Pacific Coast Region, 14° at Olympia to 17° at Portland.

Frosts.—In the various districts they were reported on the following dates: New England, 2nd 3rd, 5th to 12th, 14th, to 25th, 28th, 31st; Middle Atlantic States, 2nd, 3rd, 5th, 6th, 8th to 12th, 15th to 21st, 23rd to 26th, 30th, 31st; South Atlantic States, 6th to 13th, 15th to 20th, 24th, 25th, 30th, 31st; East Gulf States, 6th, 15th to 18th, 22nd to 24th, 27th, 30th, 31st; West Gulf States, 1st, 15th, 16th, 17th, 21st, 22nd, 24th, 26th, 29th, 30th, 31st; Rio Grande Valley, 15th, 16th, 17th, 21st, 22nd, 25th, 26th, 28th, 30th, 31st; Ohio Valley and Tennessee, 1st 2nd, 4th to 11th, 14th to 20th, 22nd to 26th, 29th to 31st; Lower Lake Region, 1st to 12th, 14th to 21st, 23rd, 24th, 25th, 30th, 31st; Upper Lake Region, 1st to 31st; Extreme Northwest, 1st to 31st; Upper Mississippi Valley, 1st to 20th, 22nd to 31st; Missouri Valley, 1st, 2nd, 4th to 18th, 21st to 31st; Northern Slope, 1st to 31st; Middle Slope, 1st to 5th, 7th to 11th, 13th to 15th, 18th to 20th, 22nd to 31st; Southern Slope, 1st, 5th, 14th, 15th, 16th, 20th to 23rd, 25th, 26th 27th, 29th, 30th; Southern Plateau, 1st to 31st; Middle Plateau, 1st to 31st; Northern Plateau, 1st to 31st; North Pacific Coast Region, 1st to 5th, 8th to 14th, 16th, 17th, 19th, 20th, 21st, 23rd, 24th, 25th, 27th, 28th; Middle Pacific Coast Region, 2nd, 3rd, 5th, 11th 13th 14th, 16th to 23rd, 25th 29th, 30th, 31st; South Pacific Coast Region, 3rd, 8th to 11th, 13th 14th, 16th to 26th, 30th, 31st.

Ice.—Regarding its formation in northern sections, this subject is considered elsewhere in the REVIEW under the head of *Ice in Rivers and Harbors*. The following are exceptional cases of ice formation in the southern portions of the country: Visalia, Cal., 20th. Fayette, Miss., 16th, 30th. Clarksville, Tex., ice formed but once during month. Ft. McKavett, Concho and Stockton, Tex., 15th. Denison, Tex., 21st. Brackettville, 31st. Memphis, 5th, 16th. Cape Lookout, N. C., 31st, ponds frozen.

PRECIPITATION.

The general distribution of rain-fall for the month of December, 1881, is exhibited upon chart No. III from the reports of over 500 stations. From the table in the left-hand corner of the chart is obtained a monthly average for each of the various districts, determined from the records of Signal Service stations covering a period of several years, to which is subjoined a comparison of the present month with such averages. Upon comparison with the chart, the tabulated averages show a general deficiency of rain-fall throughout the country west of the Mississippi, with the largest departures in the Pacific Coast States. Throughout the area of deficiency the departures range from 0.06 inch in the Southern Rocky Mountain Slope to 1.83 inches in the South Pacific Coast Region. A second area of deficiency, but comparatively small, embraces the South Atlantic States and Florida Peninsula, with departures ranging from 0.4 inch in the latter to 0.99 inch in the former. Throughout the remainder of the United States the rain-fall is above the normal, the departures of excess ranging from 0.10 inch in the Upper Lake Region to 3.12 inches in the Eastern Gulf States. As a means of interesting comparison, the following maximum departures from the average precipitation are given for each year since 1872, together with the corresponding districts: 1873, large excess, Ohio Valley, Tennessee and the Lower Lake Region; 1874, +2.00 inches, Western Gulf States; 1875, +2.65 inches, Western Gulf States and +5.64 inches in the North Pacific Coast Region; 1876, +3.00 inches, Eastern Gulf States and -4.00 inches in the Pacific Coast Regions; 1877, -2.02 inches, New England and +2.05 inches in the Eastern Gulf States; 1878, +3.20 inches, St. Lawrence valley and -3.65 inches in the North Pacific Coast Region; 1879, +2.61 inches, Ohio Valley and +4.84 inches in Tennessee; 1880, +5.02 inches, North Pacific Coast Region and +7.25 inches in the Middle Pacific Coast Region.

Deviations from Average Precipitation.—Under this heading departures exhibited by the reports from regular Signal Service stations are shown in the table of comparative monthly rain-falls, as published in the lower left-hand corner of chart No. III. The following items of importance in connection with this subject, are reported by Voluntary Observers: *Illinois*: Riley, monthly rain-fall, 0.80 inch above the average of the past 20 years; larger rain-falls were reported in 1863, 1866, 1873 and 1877. Annual rain-fall 47.22 inches, or 13.83 inches above the average of the past 20 years and 1.41 inches above the maximum annual rain-fall for that period which occurred

in 1868. Of the 47.22 inches of precipitation for 1881, 11.42 inches were melted snow; rain fell on 93 days and snow on 43 days. *Kansas*: Lawrence, the following interesting record is furnished by Prof. F. H. Snow, of the State University: monthly rain-fall 0.90 inch, or 0.84 inch below the average of the past 13 years. Annual rain-fall for the year 1881, 33.27 inches or 1.56 inches below the average of the past 13 years. Either rain or snow, or both, fell on 110 days, or 7 more than the average. The entire snow-fall for the year was 32.50 inches or 12.06 inches above the average of the past 13 years. Yates Centre, monthly rain-fall, 0.71 inch above that of 1880, and 0.50 inch below the average of 1879 and 1880. Wellington, monthly rain-fall, 0.67 inch, or about the December average of the past 3 years. *Maine*: Gardiner, monthly rain-fall, 6.56 inches or 2.88 inches above the average of the past 45 years; this amount has been exceeded but once, viz., in 1878, when the December rain-fall measured 7.55 inches. *Maryland*: Sandy Springs, monthly rain-fall, 6.01 inches; considerably above the average of the past 15 years. *Missouri*: St. Louis, the following report is furnished by Mr. B. D. Kribben: monthly rain-fall, 1.56 inches or 1.41 inches below the normal. Rain-fall for the year, 38.22 inches or 4.09 inches below the normal. St. Louis, Missouri Weather Service reports, monthly rain-fall 1.50 inches or 1.47 inches below the average of the past 44 years. *New Hampshire*: Contoocookville, monthly rain-fall, 5.80 inches, or more than double the average of the past 10 years; only about one-fourth of the average amount of snow fell. *New Jersey*: Lambertville, monthly rain-fall considerably below the average; rain-fall for the year, 32.78 inches or 9.20 inches below the average of the past 5 years. *New York*: Waterburg, monthly rain-fall, 5.04, or 2.31 inches above the average of the past 9 years. Ardenia, monthly rain-fall considerably above the average. North Volney, monthly rain-fall, 5.80 inches or 2.64 inches above the average of the past 9 years; largest monthly rain-fall during that period, 8.35 inches, fell in 1878; smallest, 1.80 inches, fell in 1875. Rain-fall for the year 33.27 inches or 4.62 inches below the average of the past 8 years; the largest annual amount, 48.35 inches, fell in 1878, and the smallest, 31.20 inches, fell in 1875. During the year 1881, rain or snow fell on 189 days. Palermo, monthly rain-fall considerably below the average; rain-fall for the year, 29.60 inches or 5.60 inches below the average of the past 10 years; snow-fall for the year, 60.50 inches. *Virginia*: Wytheville, monthly rain-fall, 4.15 inches or 1.15 inches above the average of the past 17 years. *West Virginia*: Helvetia, monthly rain-fall, 8.81 inches or 3.94 inches above the average of the past 6 years. Rain-fall for the year, 56.53 inches or 2.63 inches above the average of the past 6 years.

Special Heavy Rains.—4th, Red Bluff, Cal., 2.89 inches. 13th, Champaign, Ill., 3.21; Springfield, Ill., 3.33. 14th, Mt. Washington, 3.03; Montgomery, Ala., 2.93. 20th and 21st, Ft. Barancas, Fla., 5.23. 21st., Pensacola, Fla., 2.95; Montgomery, Ala., 3.45; Chattanooga, 2.88; Port Eads, La., 3.79. 22d, Highlands, N. C., 2.52. 25th, Port Eads, La., 3.83. 26th, Highlands, N. C., 3.95.

Largest Monthly Rain-falls, including Melted Snow.—Mt. Washington, 15.95 inches; Highlands, N. C., 14.29; Alta, Cal., 13.60; Ft. Stevens, Or., 13.47; Ft. Canby, Wash. Ty., 11.55; Port Eads, La., 11.28; Pensacola, Fla., 10.76; Montgomery, 9.75; Wellsboro, Pa., 9.57; Ft. Gaston, Cal., 9.24; Mobile, 9.15; Summit, Cal., 9.05; Victoria, B. C., 8.98; Olympia, 8.86; Chattanooga, 8.83; Helvetia, W. Va., 8.81; Cisco, Cal., 8.76; Champaign, Ill., 8.54; Berryvale, Cal., 8.25; Colfax, Cal., 8.01; Bainbridge Island, Wash. Ty., 8.00; Paterson, N. J., 7.87; Atlanta, 7.53; Halifax, N. S., 7.24; College Hill, Ohio, 7.00; Thatcher's Island, Mass., Northport, Mich., Great Falls, Md., and Orono, Me., 6.88; Forsyth, Ga., 6.85; Albany, Or. and Oswego, N. Y., 6.78; Johnstown, N. Y., 6.71; Woodstock, N. H., 6.65; Portland, Or., 6.64; New Orleans, 6.62; Antrim, N. H., 6.60; Niles, Mich., 6.59; Gardiner, Me., 6.56; Murphy, N. C., 6.55; Erie, 6.44; South Lee, Mass., 6.41; Dexter, Me., 6.40; Flemington, W. Va., 6.33; Auburn, Ala., and Ashland, N. H., 6.30; Kittyhawk, N. C., 6.29; Sandusky, 6.27; Eastport, 6.25; Lynchburg, Va., and Grafton, N. H., 6.22; Amherst, Mass., 6.15; Washington, D. C., 6.12; Bristol, N. H., 6.08; Redding, Cal., 6.07; Rising Sun, Ind., 6.05; Worcester, Mass., 6.04; Cooperstown, N. Y., 6.02; Sandy Springs, Md., 6.01; Louisville, 6.00.

Smallest Monthly Rain-falls, including Melted Snow.—Colton, Indio, Kingsburg, Lemoore, Mammoth Tank, Tuhey's Rancho and White Water, Cal., Ft. Hale and Rapid City, Dak., Casa Granda, Maricopa, Pantano and Wilcox, Ariz., and Ft. Gibson and Denver, none; Delano and Mojave, Cal., Ft. Totten and Ft. Lincoln, Dak., and Deming, N. M., trace; Cheyenne, and Ft. Washakie, Wyo., and Ft. Wallace, Kan., 0.01 inch; Deadwood, Dak., 0.02; San Simon, Ariz. and Ft. Shaw, Mont., 0.04; Tulare, Cal. and Bismarck and Huron, Dak., 0.06; Ft. Benton, Mont., 0.07; Ft. Assinnaboine, Mont., and Pioche, Nev., 0.08; Ft. Buford, Dak., 0.09; Yuma, Ariz., Ft. Garland, Cal., Ft. Randall, Dak., Ft. Keogh, Mont., Tecoma, Nev. and Ft. Union, N. M., 0.10; Yankton, 0.11; Tehachapi, Cal., 0.12; North Platte, 0.13; Florence, Ariz., 0.14; Morriston and Olivet, Dak., and Ft. Snelling, Minn., 0.15; Fresno and Sumner, Cal., 0.16; Ft. Stevenson, Dak., and Texas Hill, Ariz., 0.18; Goshen and Ravenna, Cal., and Tucson, Ariz., 0.19; Moorhead and Duluth, Minn., and Newhall, Cal., 0.20; Ft. Custer, Mont., 0.22; Ft. Supply, Ind. Ty., 0.23; Campo, Cal., 0.24; St. Vincent, Minn. and Corinne and Ogden, Utah, 0.25; La Crosse, Wis., and Ft. Elliott, Tex., 0.26; Visalia, Cal., 0.27; Silver City, N. M., 0.28; Camp near Presidio, Tex., 0.29; San Diego and Keene, Cal., 0.30; Ft. McDermitt, Nev., and Borden and

San Fernando, Cal., 0.32; Prescott, Ariz., 0.33; Rock Creek, Mont., and Ft. Apache, Ariz., 0.34; Forts Wingate and Stanton, N. M., and Minneapolis, Minn., 0.35; Ft. Bridger, Wyo., 0.36; Anaheim, Cal., 0.37; Helena, Mont., 0.38; Camp Thomas, Ariz., Pagosa Springs, Cal., Topeka, Kan., Beowawe and Toano, Nev., and Blue Creek and Promontory, Utah, 0.40; San Geronio, Cal., 0.42; Northfield, Minn., Umatilla, Or., Browns, Nev., and Terrace, Utah, 0.45; Golconda, Nev., 0.47; Genoa, Neb., Ft. Lewis, Col., and Pembina, Dak., 0.50.

Rainy Days.—The number varied in New England from 12 to 26; Middle Atlantic States, 10 to 18; South Atlantic States, 8 to 17; Florida Peninsula, 7 to 11; East Gulf States, 11 to 17; West Gulf States, 6 to 17; Rio Grande Valley, 4 to 11; Ohio Valley and Tennessee, 9 to 18; Lower Lake Region, 17 to 24; Upper Lake Region, 6 to 21; Extreme Northwest, 3 to 10; Upper Mississippi Valley, 9 to 14; Missouri Valley, 4 to 10; Northern Slope, 2 to 10; Middle Slope, 0 to 9; Southern Slope, 3 to 5; Southern Plateau, 2 to 4; Middle Plateau, 2 to 9; Northern Plateau, 3 to 16; North Pacific Coast Region, 22 to 26; Middle Pacific Coast Region, 12 to 14; South Pacific Coast Region, 2 to 6.

Cloudy Days.—The number varied in New England from 8 to 21; Middle Atlantic States, 7 to 15; South Atlantic States, 6 to 13; Florida Peninsula, 4 to 7; East Gulf States, 8 to 15; West Gulf States, 6 to 17; Rio Grande Valley, 7 to 14; Ohio Valley and Tennessee, 13 to 18; Lower Lake Region, 17 to 19; Upper Lake Region, 8 to 20; Extreme Northwest, 1 to 5; Upper Mississippi Valley, 4 to 12; Missouri Valley, 4 to 11; Northern Slope, 3 to 9; Middle Slope, 0 to 8; Southern Slope, 1 to 11; Southern Plateau, 2 to 4; Middle Plateau, 7 to 10; Northern Plateau, 4 to 16; North Pacific Coast Region, 16 to 21; Middle Pacific Coast Region, 6 to 10; South Pacific Coast Region, 2 to 9.

Largest Monthly Snowfalls.—Mt. Washington, 48.90 inches; Summit, Cal., 43.00; Cisco, Cal., 34.00; Berryvale, Cal., 26.50; Truckee, Nev., 20.50; Boston, 19.20; Emigrant Gap, Cal., 17.00; South Lee, Mass., 15.50; Alta, Cal., 15.00; Humboldt and Winnemucca, Nev., 12.00; Boca and Palisade, Nev., and Logan, Ia., 10.00; Otega, Nev., 9.75; Kelton, Utah, and White Plains, N. Y., 9.00; Ft. Missoula, Mont., 8.80; Wells, Nev., 8.50; Alpena, Mich., 8.10; Lunenburg, Vt., and Eagle Rock, Idaho, 8.00; Marquette, Mich., 7.60; Highland, N. C., 7.50; De Soto, Neb., and Carson City, Nev., 6.50; Escanaba and Grand Haven, 6.40; Omaha, 6.30; Halleck, Nev., Dexter, Me., North Volney, N. Y., and Independence, Ia., 6.00.

Snow.—The dates on which snow fell in the various districts are as follows: New England, 1st to 5th, 7th to 16th, 18th to 25th, 27th, 29th, 30th, 31st; Middle Atlantic States, 3d to 5th, 10th to 12th, 14th, 15th, 23d, 24th, 28th, 30th, 31st; South Atlantic States, 15th, 16th, 23d, 29th, 30th, 31st; East Gulf States, New Orleans, 25th, only a few flakes; Auburn, Ala., 29th, slight fall; Ohio Valley and Tennessee, 7th, 10th, 11th, 15th, 23d, 29th, 30th, 31st; Lower Lake Region, 3d to 8th, 10th, 11th, 14th, 15th, 23d, 29th, 30th, 31st; Upper Lake Region, 1st to 15th, 20th, 26th to 31st; Extreme Northwest, 1st, 2d, 8th, 9th, 12th, 13th, 19th, 20th, 28th to 31st; Upper Mississippi Valley, 1st to 3d, 7th, 8th, 10th to 13th, 21st, 27th to 31st; Missouri Valley, 10th, 19th to 22d, 29th to 31st; Northern Slope, 1st, 2d, 6th to 12th, 14th, 15th, 17th, 18th, 20th, 24th to 28th; Middle Slope, 1st, 2d, 10th, 19th, 20th, 21st, 25th to 28th; Southern Plateau, 16th to 20th; Middle Plateau, 1st, 2d, 3d, 6th, 9th to 12th, 25th to 29th; Northern Plateau, 1st, 2d, 4th, 5th, 8th, 10th to 13th, 15th, 16th, 18th, 19th, 24th to 27th, 29th; North Pacific Coast Region, 1st, 2d, 3d, 6th to 10th, 12th, 13th, 14th, 16th, 19th, 20th, 21st, 23d, 25th, 26th, 27th. The following is a report of unusually heavy snow: Spokane, Wash. Ty., 24th. The N. P. R. R. Co. were obliged to use snow plows on the Spokane division, the snow being from two to three feet deep in that section.

Depth of Snow on Ground at End of Month.—*Colorado:* Pike's Peak, trace. *Dakota:* Bismarck, 2 inches. *Illinois:* Cairo, 1 inch; Chicago, trace; Charleston, $\frac{1}{2}$ inch; Morrison, $\frac{1}{2}$ inch; Anna, $2\frac{1}{2}$ inches; Riley, trace. *Indiana:* Laconia, $\frac{1}{2}$ inch; Wabash, Logansport and Vevay, 1 inch; St. Meinrad, $\frac{1}{2}$ inch; Indianapolis, trace. *Iowa:* Dana, 1 inch; Fort Madison, 2 inches; Davenport, trace; Des Moines, $\frac{1}{2}$ inch. *Kentucky:* Bowling Green, $1\frac{1}{2}$ inches. *Maine:* Eastport, trace. *Maryland:* Woodstock, trace. *Massachusetts:* New Bedford, $\frac{1}{2}$ inch. *Michigan:* Marquette, 6 inches; Grand Haven, 5 inches; Escanaba, 2 inches; Detroit, $1\frac{1}{2}$ inches; Alpena, $\frac{1}{2}$ inch; Port Huron, trace; Battle Creek, 2 inches; Litchfield, 1 inch; Kalamazoo, 3 inches. *Minnesota:* Moorhead, trace; St. Vincent, 10 inches; St. Paul, less than 1 inch; Duluth, $\frac{1}{2}$ inch. *Missouri:* St. Louis, 1 inch. *Nebraska:* De Soto, $\frac{1}{2}$ inch. *New Hampshire:* Mt. Washington, 7 inches. *New York:* Pen Yan, 3 inches; Waterburg, Ithaca and Palermo, 2 inches; Coopers-town, $1\frac{1}{2}$ inches; North Volney, $2\frac{1}{2}$ inches; Friendship, 1 inch; White Plains, trace; Buffalo, 4 inches; Rochester, 2 inches; Oswego, 3 inches. *North Carolina:* Highlands, 5 inches; Charlotte, 4 inches. *Ohio:* North Lewisburg, New Athens, Bethel and Jacksonburg, 2 inches; Bellefontaine and Ruggles, 1 inch; Toledo and Sandusky, $\frac{1}{2}$ inch; Cleveland, 1 inch; Columbus, 1 inch; Cincinnati, $\frac{1}{2}$ inch. *Pennsylvania:* Dyberry and New Castle, 1 inch; Meadville, $1\frac{1}{2}$ inches; Catawissa, $\frac{1}{2}$ inch; Wellsboro, trace; Erie, 10 inches. *Rhode Island:* Newport, trace. *Tennessee:* Ashwood, 2 inches; Chattanooga, $\frac{1}{2}$ inch. *Vermont:* Burlington, $\frac{1}{2}$ inch. *Virginia:*

Wytheville, $\frac{1}{2}$ inch. *Washington Territory*: Spokane Falls, 5 inches. *West Virginia*: Flemington, 1 inch; Morgantown, $\frac{1}{2}$ inch. *Wisconsin*: Beloit and Embarrass, $\frac{1}{2}$ inch.

Hail.—Dubuque, 20th, from 7.03 to 7.08 p. m. Bangor, Me., 18th, a slight hail storm between 10 and 11 a. m. North Volney, N. Y., 12th. Greensboro, N. C., 29th. Wytheville, Va., 1st, 29th. Albany, 8th.

Rain, Hail or Snow from a Cloudless Sky.—Wellington, Kan., 7th, shower of spongy hail, lasting three minutes. Bainbridge Island, Wash. Ty., 18th, rain. Dyberry, Pa., snow, lasting 30 minutes.

RELATIVE HUMIDITY.

The percentage of mean relative humidity for the month ranges as follows: New England, from 73 to 79; Middle Atlantic States, 67 to 80; South Atlantic States, 66 to 83; Florida Peninsula, 75 to 78; East Gulf States, 68 to 79; West Gulf States, 68 to 85; Rio Grande Valley, 72 to 85; Ohio Valley and Tennessee, 70 to 77; Lower Lake Region, 66 to 80; Upper Lake Region, 66 to 87; Extreme Northwest 71 to 87; Upper Mississippi Valley, 65 to 79; Missouri Valley, 65 to 70; Northern Slope, 53 to 71; Middle Slope, 47 to 70; Southern Slope, 56 to 75; Southern Plateau, 50 to 63; Middle Plateau, 42 to 80; Northern Plateau, 73 to 86; North Pacific Coast Region, 84 to 86; Middle Pacific Coast Region, 84 to 86; South Pacific Coast Region, 47 to 80. *High stations* report the following percentages not corrected for altitude: Cheyenne, 48.0; Pike's Peak, 66.4; Mt. Washington, 84.4.

WINDS.

The prevailing winds during the month of December, 1881, at Signal Service stations, are shown on chart No. II, by arrows, which fly with the wind. Throughout the Ohio Valley, Lake Region, Upper Mississippi Valley, and New England, the winds are *southerly*; in the Middle Atlantic States *westerly*; in the South Atlantic and Eastern Gulf States, *northeasterly*; in the Western Gulf States and Texas, *variable*; in the Missouri Valley, and Northwest, *northwesterly*; throughout the Northern Slope, Northern Plateau, and North Pacific Coast Region, *south to west*; in California, *northwesterly*; elsewhere, *variable*.

Total Movements of the Air.—The following are the largest total movements at Signal Service stations: Mt. Washington, 31,104 miles; Pike's Peak, 17,972; Ft. Shaw, Mont., 13,651; Delaware Breakwater, 12,833; New Shoreham, R. I., 12,736; Kittyhawk, N. C., 12,595; Wood's Holl, Mass., 12,166; Thatchers Island, Mass., 12,064; Hatteras, N. C., 12,035; Cape May, 12,018; Sandy Hook, N. J., 10,791; Sandusky, 10,339; Ft. Benton, Mont., 10,118; Portsmouth, N. C., 9,762; Ft. Assinnaboine, Mont., 9,661; Indianola, 9,621; Barnegat, N. J., 9,524; Macon, N. C., 9,376; Champaign, Ill., 9,321; Port Eads, 9,303; Cheyenne, 9,174; Buffalo, 9,172; Rochester, 9,126; Cape Henry, Va., 8,799; Grand Haven, 8,728; Milwaukee, 8,456; St. Vincent, Minn., 8,405; Key West, 8,256; Atlanta, 8,158; Burlington, Vt., 8,069; Boston, 8,047. The *smallest* are: La Mesilla, N. M., 725; Ft. Misoula, Mont., 1,359; Lynchburg, Va., 1,365; Salt Lake City, 1,473; Visalia, Cal., 1,700; Red Bluff, Cal., 2,250; Memphis, 2,365; Silver City, N. M., 2,452; Boise City, 2,534; Springfield, Mass., 2,892; Florence, Ariz., 2,939; Rio Grande, Tex., 2,970.

High Winds.—On the summit of Mt. Washington the highest velocities recorded were: 170 miles, NW., 1st; 100, NW., 2d; 104, W., 14th; 126, SW., 22d. The dates other than those above mentioned, on which velocities exceeding 75 miles per hour occurred, are as follows: 6th to 10th, 12th, 13th, 15th, 17th, 18th, 20th 24th to 26th, 29th, 30th. On summit of Pike's Peak, maximum velocity, 76 miles, NW., occurred on the 29th; velocities of 50 miles or over were recorded as follows: on the 5th, 10th, 12th, 27th, 28th, 30th. Other high velocities were reported by the following stations: Ft. Assinnaboine, Mont., 50 miles, SW., 26th; Ft. Benton, Mont., 52, NW., 7th; Ft. Custer, Mont., 52, W., 11th; Port Eads, La., 52, E., 25th; Cape May, 52, NW., 7th; Delaware Breakwater, 54, NW., 23d; Kitty Hawk, N. C., 56, N., 15th.

Local Storms.—Fremont, Ohio, 9th, several buildings wrecked; unusually high westerly winds during the day. Terrene, Miss., 13th, "heaviest storm ever known here, occurred during the evening." Pensacola, Fla., 25th, heavy SE. gale; signs, etc., blown down; bark driven ashore outside of harbor. Macon, N. C., 27th, heavy SW. gale; fishing smack blown ashore.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for December, 1881, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 88.95 per cent. The percentages for the four elements are: Weather, 90.28; Direction of the Wind, 89.42; Temperature, 88.66; Barometer, 87.29 per cent. By geographical districts they are: For New England, 91.8; Middle Atlantic States, 91.5; South Atlantic States, 91.6; Eastern Gulf States, 88.6; Western Gulf States, 85.4; Lower Lake Region, 89.8; Upper Lake Region, 88.6; Tennessee and the Ohio Valley, 88.4; Upper Mississippi Valley, 86.3; Lower

Missouri Valley, 87.2; Northern Pacific Coast Region, 92.5; Central Pacific Coast Region, 89.2; Southern Pacific coast region, 86.9. There were 70 omissions to predict (31 being due to the absence of reports from the Pacific coast) out of 3,813, or 1.83 per cent. Of the 3,743 predictions that have been made, 57, or 1.52 per cent. are considered to have entirely failed; 53, or 1.42 per cent. were one-fourth verified; 391, or 10.45 per cent. were one-half verified; 485, or 12.95 per cent. were three-fourths verified; 2,757, or 73.56 per cent. were fully verified, so far as can be ascertained from the tri-daily reports.

Cautionary Signals.—139 Cautionary signals were displayed during the month of December, 1881, of which 125, or 89.92 per cent., were fully justified by winds of twenty-five miles per hour, or over, at or within a radius of 100 miles of the station. Ninety Off-shore signals were displayed, of which 73, or 81.11 per cent., were fully justified; 86 or 95.55 per cent., were justified as to direction; 88, or 97.77 per cent., were justified as to velocity. Thirty-nine Off-shore signals were changed from Cautionary. Thirteen Northwest signals were displayed, all of which were fully justified. 242 signals of all kinds were displayed, of which 210, or 86.77 per cent. were fully justified. The above does not include signals ordered at 67 display stations, where the velocity is only estimated. 147 winds of 25 miles or over, were reported, for which no signals were ordered. 44 signals were ordered late.

NAVIGATION.

Stage of Water in Rivers.—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water as observed at Signal Service stations during the month of December, 1881. In general the principal rivers of the country have remained at a moderate stage throughout the month. The formation and breaking up of ice has to a considerable extent interfered with the taking of river observations. At La Crosse the river was frozen over from the 10th to the 19th; Yankton, 1st to 27th and St. Paul, 9th to 14th. In the Mississippi the highest water occurred at Memphis on the 31st when it reached within 4 feet 4 inches of the danger-line. The Missouri reached within from 11 to 17 feet of the danger-line at stations between Leavenworth and Yankton. The Ohio reached its highest water at Pittsburg on the 28th, within 3 feet 2 inches of the danger-line. The Red, Cumberland, Tennessee, Monongahela and Savannah rivers reached their highest stage between the 23rd and 31st, generally after the 27th, the water reaching within from 11 to 15 feet of the danger-line.

Ice in Rivers and Harbors.—*Missouri River:* Yankton, river frozen from 1st to 26th; open on 27th. Leavenworth, 30th, slush ice in river. *Lake Huron:* Alpena, 9th, 10th, 11th, 18th, 27th, floating ice; 15th, bay and river partly frozen over. *Connecticut River:* Springfield, Mass., 12th, river frozen. *Lake Superior:* Duluth, 31st, floating ice inside the Breakwater. *Maumee River:* Toledo, 11th, floating ice. *Hudson River:* Albany, 11th, river frozen; 12th, 13th, 16th, floating ice; 14th, 18th, river free from ice. *Rock River:* Rockford, Ill., 10th, floating ice; 11th, frozen, over; 13th, clear of ice; 15th, floating ice; 19th, clear of ice; 30th, river frozen. *Muscatine River:* Muscatine, Ia., 4th, clear of ice; 10th, floating ice; 13th, ferry boats stopped running on account of ice. *Kennebec River:* Gardiner, Me., 11th, river closed; 14th, ice broke in river; 16th, river closed; 30th, river open. *Grand River:* Lansing, Mich., 10th, river closed; 13th, river open; 31st river closed. *Mississippi River:* Dubuque, 10th, 30th, floating ice in river. Burlington, 30th, 31st, floating ice in river. Keokuk, 31st, floating ice in river. La Crosse, 10th, 31st, river frozen. Davenport, 19th, 30th, 31st, floating ice in river. St. Paul, 9th, 31st, river frozen; 4th, 8th, 30th, floating ice; 15th, river frozen along the shores; floating ice in channel; 22d, river nearly clear of ice; 30th, gorge threatened in river. The following stations report an unusual absence of ice: Lawrence, Kan., river free from ice throughout the month; Northport, Mich., 31st, no ice in Lake Michigan or Traverse Bay; Clear Creek, Neb., 31st, first December for eight years that Platte river did not freeze.

Closing of Navigation.—Burlington, Ia., 3d, all boats on the Upper Mississippi have gone into winter quarters; the last boat that touched this point was the "White Eagle," bound for St. Louis; river reported clear of ice from this station northward to St. Paul. La Crosse, 31st, navigation closed. Cleveland, 15th, navigation virtually closed; nearly all vessels laid up and out of commission; all regular lines have suspended for the winter. Chicago, 30th, navigation generally closed; occasional "arrivals and clearings" are likely to continue as long as the weather permits. Albany, 8th, canal closed; navigation on river practically ended. Catawissa, Pa., 14th, navigation on north branch of canal closed.

Floods.—*Illinois:* Ottawa, 22nd, very heavy and constant rains for the past three days; streams flooded and considerable damage done. *Virginia:* Petersburg, 22d, all streams greatly swollen by heavy rains and several bridges washed away. Belfield, 23d, bridge over the Meherin river washed away. *Tennessee:* Nashville, 25th, the low lands in northern section of the city have been flooded during the past few days; no damage reported. *New York:* Albany, 23d, heavy freshet interfering with river navigation. 28th, heavy rains caused freshet in river, submerging docks and flooding cellars along Quay street; damage slight. Poughkeepsie, 23d, river unusually high.

Water Spouts.—Punta Rassa, Fla., 5th, 4.30 p. m., a large water spout formed over the Gulf, apparently at a distance of about 8 miles from station. In appearance it resembled a long, crooked, leaden-colored pipe or hose, extending upward from a base of whirling spray to a mass of cumulo-stratus clouds. It remained nearly stationary, the trunk at times being bent and swayed about by the wind. The phenomenon was visible for about five minutes.

Drought.—Los Angeles, Cal., 24th, farmers apprehend drought; rainy season very backward and the usual water-supply very low. Weldon, N. C., 31st, wells have not yet recovered from the effects of the late drought.

Low Tides.—Life-saving Station, No. 6, N. C., 31st, during almost the entire month, the tide in the Sound has been so low that navigation was seriously affected; this unusual state of the tide was probably due to numerous northerly gales.

High Tides.—New Westminster, B. C., 23rd, very high, flats flooded. Port Eads, La., 19th.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the left hand side of chart No. III. Observations made at Chincoteague and Portland, Me., came too late for publication.

ATMOSPHERIC ELECTRICITY.

Auroras.—The auroral displays during the month of December, 1881, were quite numerous, but none of them are characterized as unusually brilliant. The display of the 18th at Augusta, Ga., is perhaps the most remarkable, owing to its extreme southern latitude. The observer at that station reports the first appearance of the aurora as occurring at 7 p. m., in the northwest horizon; color, faint rose of a diffuse light, with an altitude of 15° and an azimuth of 40° ; disappeared at 7.10 p. m. At 10.41 p. m. it reappeared, lasting about 15 minutes, but the color had apparently changed to a pale yellow. The following are general displays of considerable extent: The display of the 8th was witnessed from Eastport, Me., westward to Fort Buford, Dak., the following intervening stations reporting. Eastport, 6.30 to 9 p. m.; Cornish, Me., 6 to 8 p. m.; Gardiner, Me., 6.30 to 9 p. m.; Orono, Me., 7 p. m.; Dexter, Me., 6.30 to 8 p. m.; Newport, Vt., 7 p. m.; Williamstown, Mass., 7 to 9 p. m.; Fall River, Mass., 7 p. m.; New Corydon, Ind., during the night, with streamers reaching an altitude of 20° ; Marquette, 6.30 to 7 p. m.; Franklin, Wis., 7 p. m.; Duluth, 6.30 to 7.45 p. m.; Northfield, Minn., 7 p. m.; Morrison, Ill., 7 p. m.; St. Vincent, Minn., 6.30 to 7.30 p. m.; Fort Buford, Dak., 10.30 p. m. The display of the 9th and 10th was probably a continuation of the 8th, as at several stations it was observed throughout the night. Portland, Me., 10th, 7 to 9 p. m.; Cornish, Me., 10th, 7 p. m.; Gardiner, Me., 10th, 7 to 9 p. m.; Harvard College, Cambridge, Mass., 10th, 6 p. m.; Williamstown, Mass., 10th, 9 p. m.; Fall River, 10th, 7 p. m.; Newport, Vt., 10th, 7 p. m.; Woodstock, Vt., 10th, 7 p. m.; Southington, Conn., 9th, 8 p. m., with streamers; New Corydon, Ind., 9th, during the night; Lansing, Mich., 10th, 7 p. m.; Fort Stevenson, Dak., 10th, 7.30 to 10.30 p. m.; Bismarck, 9th, 8 p. m. The most general display of the month was that of the 23d, the line of observation reaching from New Brunswick westward to Idaho; the following intervening stations reporting: Gardiner, Me., visible about midnight; Mt. Washington, 7.22 to 11 p. m.; Williamstown, Mass., 9 p. m.; Southington, Conn., 10.30 p. m.; Ardenia, N. Y., 8 p. m.; Waterburg, N. Y., 9 p. m.; Wellsboro, Pa., 8.30 p. m.; Washington, D. C., 8.15 to 9 p. m.; Rochester, 6.45 to 11.55 p. m.; Buffalo, 7 to 10 p. m.; Erie, 6.50 to 7.20 p. m.; Jacksonburg, O., 7 p. m.; Bellefontaine, O., 6.30 to 7.40 p. m.; North Lewisburg, O., 8 p. m.; Ruggles, O., 8 to 9 p. m.; Lansing, Mich., 7 p. m.; Litchfield, Mich., 8 p. m.; Thornville, Mich., 7 p. m.; Detroit, 10 p. m., to morning of 24th; Alpena, 5.30 p. m., to morning of 24th; Grand Haven, 7 to 10 p. m.; Escanaba, 6 to 11 p. m.; Marquette, 6.35 to 10.30 p. m.; Northfield, Minn., 8 p. m.; Duluth, 6.30 to 9.30 p. m., Beloit, Wis., 7.30 p. m.; Manitowoc, Wis., 8 p. m.; Franklin, Wis., 8 p. m., very brilliant; St. Paul, 8 p. m.; Riley, Ill., 7 to 10.30 p. m.; Cresco, Ia., 7 to 9 p. m.; Fort Madison, Ia., 7.30 p. m.; Guttenburg, Ia., 7 to 9 p. m.; Monticello, Ia., 8 p. m.; Muscatine, Ia., 9 p. m.; Dana, Ia., 8.30 p. m.; Clear Creek, Neb., 8.30 p. m.; Morrilton, Dak., 7 p. m.; St. Vincent, Minn., 6 p. m. to midnight; Fort Bennett, Dak., 8.30 p. m.; Bismarck, 6 p. m. to morning of 24th; Ft. Stevenson, Dak., 8 p. m. to morning of 24th; Ft. Assinnaboine, Mont., 6 p. m. to morning of 24th. Throughout the Northwest this display appeared to commence on the 20th and 21st, as follows: Ft. Assinnaboine, Mont., 20th, 9 p. m. to morning of 21st; 22d, 7 p. m. to morning of 23d; Ft. Stevenson, Dak., 22d 9 p. m. to morning of 23d; St. Vincent, Minn., 7 p. m. to morning of 23d. The display of the 24th and 25th was probably a continuation of the 23d. Eastport, 24th, 7.40 p. m., to midnight; Gardiner, Me., 24th, 8 to 10 p. m.; Harvard College, Cambridge, Mass., 25th, 10.30 p. m.; Dyberry, Pa., 24th, 9 p. m.; Oswego, 24th, 10.45 to 11.50 p. m.; Rochester, 9 to 11.45 p. m.; Buffalo, 10.45 to 11.10 p. m.; Grand Haven, 24th, 8 p. m. to morning of 25th; Alpena, 24th, 7.30 to 11.15 p. m.; Northport, Mich., 24th, 10.25 p. m.; Escanaba, 24th, 8 to 11.30 p. m.; Marquette, 24th, 10.30 to 11.30 p. m.; Cresco, Ia., 24th, 10 p. m.; Monticello, Ia., 24th, 10.30 p. m.; Northfield, Minn., 24th, 10 p. m.; Fort Snelling, Minn., 25th, 8 p.,

m.; St. Vincent, Minn., 25th, 8 to 10.30 p. m.; Olivet, Dak., 24th, 10 p. m.; Fort Stevenson, Dak., 6 to 8 p. m.; Fort Sully, Dak., 25th, about 9 p. m.; Fort Assinnaboine, Mont., 24th, 6 p. m. to morning of the 25th; Helena, Mont., 24th, 8 p. m. The following were local displays: Eastport, 11th, 11 p. m. to midnight; Harvard College, Cambridge, Mass., 5th, 10 to 11 p. m.; New Corydon, Ind., 7th, visible for a short time after sunset; Ft. Wayne, Ind., 20th, 9 p. m.; Port Huron, 4th, 9 to 10.12 p. m.; Clear Creek, Neb., 17th, 8 p. m.; Duluth, 14th, 8 to 10.40 p. m.; St. Vincent, 12th, 7 p. m. to midnight; Fort Stevenson, Dak., 11th 10.30 p. m. to morning of 12th; Fort Assinnaboine, Mont., 11th, 7 to 10.30 p. m.; 12th, 6 to 9.30 p. m.; Northfield, Minn., 14th, 9 p. m.

Thunder-storms.—They were reported in the various States and Territories as follows: Alabama, on the 13th, 14th, 28th; Arizona, 17th; Arkansas, 13th; Florida, 5th, 13th, 14th, 20th, 28th, 29th; Georgia, 4th, 29th; Illinois, 12th, 13th, 28th; Indiana, 1st, 12th, 13th, 14th, 19th; Indian Territory, 12th, 13th; Iowa, 1st, 7th, 12th, 13th, 20th, 27th; Kansas, 10th, 12th, 18th; Kentucky, 14th; Louisiana, 13th, 14th, 20th, 28th; Michigan, 12th, 20th; Mississippi, 3rd, 13th, 14th, 28th; Missouri, 2nd, 10th, 12th, 13th, 19th to 22nd; North Carolina, 29th, 30th; Tennessee, 13th, 28th; Texas, 13th, 19th; Virginia, 22nd, 20th.

Zodiacal Light.—St. Vincent, Minn., 13th; Springfield, Ill., 15th; Nashville, Tenn., 15th to 18th; Kittyhawk, N. C., 17th; New Corydon, Ind., 8th, 9th, 10th, 15th to 19th, 23rd, 24th, 25th, 28th; Monticello, Ia., 31st; Cambridge, Mass., 8th, 10th, 11th, 15th, 16th, 18th, 19th, 21st; Somerset, Mass., 9th, 10th, 15th to 21st; Northport, Mich., 8th, 23rd; Clear Creek, Neb., 14th, 16th, 22d, 23d; Atco, N. J., 17th; Dyberry, Pa., 24th; Wytheville, Va., 17th.

Telegraphic Communication Interfered with by Atmospheric Electricity.—Brackettville, Texas, 19th.

OPTICAL PHENOMENA.

Lunar halos have been observed in the various districts on the following dates: New England, 1st to 4th, 6th, 8th, 9th, 11th, 13th, 31st; Middle Atlantic States, 1st to 6th, 8th, 9th, 10th, 25th, 26th, 28th, 29th, 31st; South Atlantic States, 1st, 3rd, 4th, 6th, 7th, 24th, 26th, 28th, 31st; Florida Peninsula, 3rd, 7th, 28th; East Gulf States, 1st, 6th, 24th, 31st; West Gulf States, 2nd to 6th, 8th, 9th, 13th, 26th, 31st; Rio Grande Valley, 26th, 29th; Ohio Valley and Tennessee, 1st, 2nd, 5th to 10th, 12th, 14th, 16th, 24th, 28th to 31st; Lower Lake Region, 1st, 2nd, 5th, 8th, 9th, 11th, 20th, 24th, 25th, 29th, 30th; Upper Lake Region, 1st, 2nd, 7th to 9th, 16th, 26th to 30th; Extreme Northwest, 3rd, 10th, 24th, 27th, 28th, 31st; Upper Mississippi Valley, 1st, 2nd, 4th, 7th, 8th, 10th, 16th, 17th, 24th to 31st; Missouri Valley, 1st, 5th, 7th, 19th, 25th to 29th; Northern Slope, 1st, 3rd to 5th, 8th, 9th, 11th, 25th, 26th, 29th, 30th, 31st; Middle Slope, 1st, 2nd, 5th, 10th, 26th, 30th; Southern Slope, 2nd, 3rd, 5th, 6th, 7th, 9th, 12th, 13th, 16th, 17th, 24th, 25th, 26th, 30th; Southern Plateau, 1st, 4th to 7th, 10th, 25th, 26th, 27th, 31st; Middle Plateau, 4th, 7th, 8th, 15th, 20th, 26th, 28th, 31st; Northern Plateau, 3rd, 8th, 10th, 27th to 30th; North Pacific Coast Region, 30th; Middle Pacific Coast Region, 3rd, 21st, 25th, 28th to 31st; South Pacific Coast Region, 1st to 5th, 10th, 27th, 29th, 30th, 31st.

Solar halos have been observed in the various districts on the following dates: New England, 2d, 6th, 9th, 10th, 12th, 20th, 21st; Middle Atlantic States, 2d, 3d, 8th, 11th, 12th, 14th, 19th, 20th, 21st; South Atlantic States, 1st, 2d, 20th, 25th, 26th, 31st; Florida Peninsula, 21st, 24th, 25th; East Gulf States, 24th, 29th; Ohio Valley and Tennessee, 5th, 8th, 9th, 10th, 12th, 16th to 20th, 21st, 28th, 29th, 30th; Lower Lake Region, 2d, 11th, 20th, 29th; Upper Lake Region, 16th, 19th, 27th; Extreme Northwest, 10th, 18th; Upper Mississippi Valley, 1st, 3d, 7th, 8th, 10th, 16th to 19th, 24th to 27th, 29th to 31st; Missouri Valley, 9th, 25th, 26th; Northern Slope, 7th, 26th, 28th, 29th; Middle Slope, 1st, 13th, 17th, 26th, 28th, 30th, 31st; Southern Slope, 13th, 22d; Southern Plateau, 2d, 11th, 25th, 31st; Middle Plateau, 14th, 29th, 31st; Northern Plateau, 8th, 14th, 22d, 28th; Middle Pacific Coast Region, 5th, 8th, 14th, 20th, 21st, 24th, 25th, 28th, 31st; South Pacific Coast Region, 3rd, 4th, 5th, 10th, 21st.

Mirage.—Indianola, 1st, 5th, 16th, 20th to 23d, 26th, 30th; Northport, Mich., 15th, 23d, 26th; Genoa, Neb., 13th, portions of the city of Columbus, 19 miles distant, were distinctly visible.

MISCELLANEOUS PHENOMENA.

Earthquakes.—Eureka, Nev., Dec. 7th, very heavy shock. Kingston, Jamaica, Dec. 26th, 11.45 p. m., slight shock, lasting less than one second. Hawaii, Sandwich Islands, Sept. 30th, 5 a. m., "the most terrible shocks experienced in the past 40 years. The first shock came suddenly with a quick, jerking, terrific crash, as if the foundations of everything about were shattered to pieces; this shock lasted about two minutes with an interval of nearly three minutes, when there followed a second shock similar to the first but not quite equal in terrific violence. Some light tremblings were felt during the remainder of the day and three moderate shocks on the following day. Light shocks continued at intervals to October 3rd inclusive. During this period of earthquake disturbance, from September 30th to October 4th, many buildings were terribly shattered; stone houses were subjected to the greatest injury; many miles of stone wall fencing were

destroyed and most of the cisterns in the city shattered and deprived of water. Everything moveable in the houses, such as crockery, glassware and furniture, even where the building was not particularly damaged, was jumbled and thrown together in confusion. Many buildings had from 20 to 30 cracks in the walls, while the great shock of 1868 did not disturb the walls at all."

Meteors.—Boise City, 9th, 18th; Umatilla, 8th; Yuma, Ariz., 7th; Helena, Mont., 11th, 9.30 p. m., started from a point a little southwest of the zenith, and moved in a southwesterly direction, traversing an arc of 30°; exploded with a loud report and burst into fragments. During its flight, which lasted 5 seconds, the surrounding country was brilliantly illuminated. Davenport, Ia., 6th, Madison, Wis., 10th; Little Rock, 17th; Wood's Holl, Mass., 1st; Morrison, Ill., 16th; Charleston, Ill., 23d; New Corydon, Ind., 10th, 14th, 15th; Yates Centre, Kan., 8th; Dexter, Me., 11th; Rowe, Mass., 25th; Springfield Mass., 10th; Fayette, Miss., 18th, 28th, 30th; Freehold, N. J., 11th; Palermo, N. Y., 17th; Jacksonburg, O., 24th; Fallsington, Pa., 10th.

Migration of Birds.—*Geese flying southward:* Red Bluff, Cal., 5th, 11th; Dexter, Me., 8th; Somerset, Mass., 12th, 15th, 16th, 18th, 20th; Fall River, Mass., 20th; Austin, Tenn., 9th, 30th; Strafford, Vt., 21st. *Flying northward:* Indianola, 16th; Fort Madison, Ia., 2d; Strafford, Vt., 22d. *Flying northeastward:* Visalia, Cal., 1st; Indianola, 26th. *Flying southeastward:* Davenport, Ia., 22d. *Flying southwestward:* Indianola, 22d. *Ducks flying southward:* Clear Creek, Neb., 9th. *Flying westward:* Yates Centre, Kan., 12th. *Flying eastward:* Graham, Tex., 7th.

Polar Bands.—Prescott, Ariz., 1st, 2d, 21st; Nashville, Tenn., 30th; Augusta, Ga., 10th; New Corydon, Ind., 16th, 17th, 18th, 25th, 29th. Guttenburg, Ia., 1st; Dana, Ia., 1st, 12th; Yates Centre, Kan., 1st, 5th, 6th, 10th, 31st; Gardiner, Me., 2d, 9th; Clear Creek, Neb., 1st, 4th, 5th, 6th, 17th, 18th, 19th, 21st, 26th, 27th, 30th; Freehold, N. J., 9th, 18th; Vineland, N. J., 2d, 9th, 10th.

Prairie and Forest Fires.—Bismarck, D. T., 16th, 17th, 18th; Fort Supply, Ind. T., 8th, 9th, 12th, 14th to 16th; Fort Gibson, Ind. T., 9th, 11th, 22d; Fort Stevenson, D. T., 5th, 12th, 17th, 23d to 26th; Yankton, 8th, 9th, 18th, 19th, 24th to 28th; Fort Totten, D. T., 22d, 25th, 26th, 27th.

Sand Storms.—San Carlos, Ariz., 14th, 15th; Camp Thomas, Ariz., 10th, 12th, 14th, 15th, 29th; Ft. Garland, Col., 28th.

Sunsets.—The characteristics of the sky as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 184 stations show 5,654 observations to have been made of which 32 were reported doubtful; of the remainder, 5,622, or 86.5 per cent., were followed by the expected weather.

Sun Spots.—The following record of observations has been forwarded by Mr. D. P. Todd, Director of the Lawrence Observatory, Amherst, Mass:

DATE— Dec., 1881.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		REMARKS.
	Groups	Spots	Groups	Spots	Groups	Spots	Groups	Spots	
2, 10 a. m.	2	20†	0	0	3	30†	Many of the spots small. 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
3, 2 p. m.	1	15	.....	.....	0	0	3	35†
6, 11 a. m.	1	2	.....	.....	1	2	3	25†
9, 11 a. m.	2	7	0	5	1	3	3	30†	
10, 11 a. m.	2	8	1	3	1	2	4	33†	
11, 9 a. m.	0	0	0	5	0	0	0	30†	
16, 12 m.	.....	.....	.....	.....	.....	.....	6	25†
17, 10 a. m.	0	0	0	5	0	0	0	20†	
18, 2 p. m.	0	0	1	2	0	0	4	17	
9, 12 m.	0	0	1	5	0	0	3	12	
24, 3 p. m.	1	12	Broad areas of faculae.
25, 12 m.	0	0	0	3	0	0	1	9	
27, 2 p. m.	2	7	0	6	0	0	3	10	
28, 2 p. m.	1	4	1	2	1	2	3	12	
30, 4 p. m.	0	0	0	0	0	0	3	12	
31, 4 p. m.	0	0	0	0	0	3	3	15	
.....	

†Approximated.

Faculae were seen at the time of every observation.

Mr. H. D. Govey, at North Lewisburg, Ohio, reports: Sun spots observed on every clear day during the month. They were largest on the 5th, 17th; smallest, on the 10th; most numerous on the 15th, and least numerous on the 23d.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

W. B. HAZEN,

Brig. & Bvt. Maj. Gen'l,
Chief Signal Officer, U. S. A.

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No. I.

WINTER WEATHER MAP.

U.S. ARMY.
FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.



OF AREAS OF LOW BAROMETER FOR DECEMBER, 1881.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR

W.B. Bayne

BRIG. & BVT. MAJ. GEN'L. CHIEF SIGNAL OFFICER, U. S. A.
at Long, West from 32 Greenwich

NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 3 P. M., and 11 P. M. (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

W.B. BAYNE

WAR DEPARTMENT WE

SIGNAL SERVICE, U.S. ARMY
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF

ISOBARS, ISOTHERMS AND PREVAILING WINDS

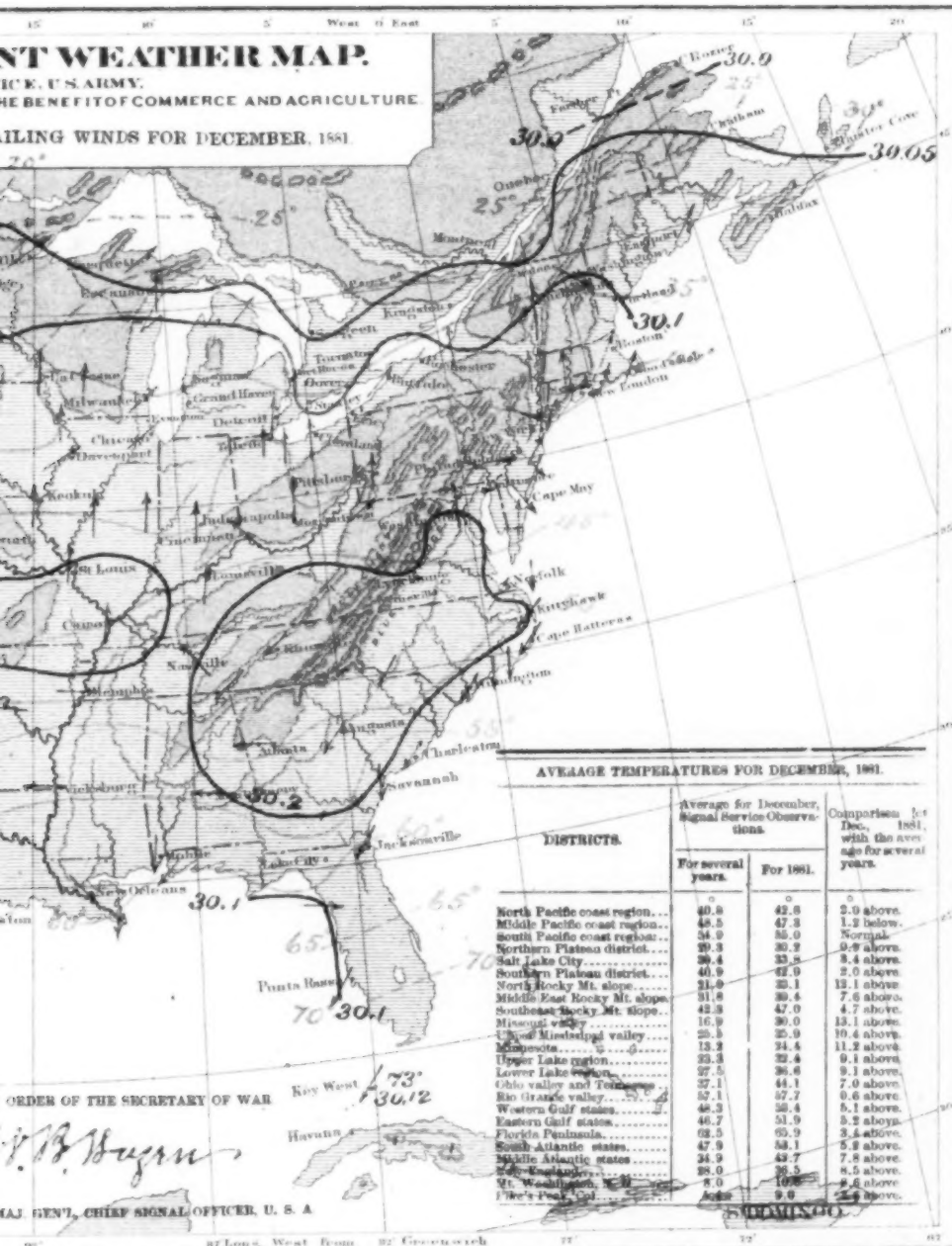


PUBLISHED BY ORDER OF THE

1873

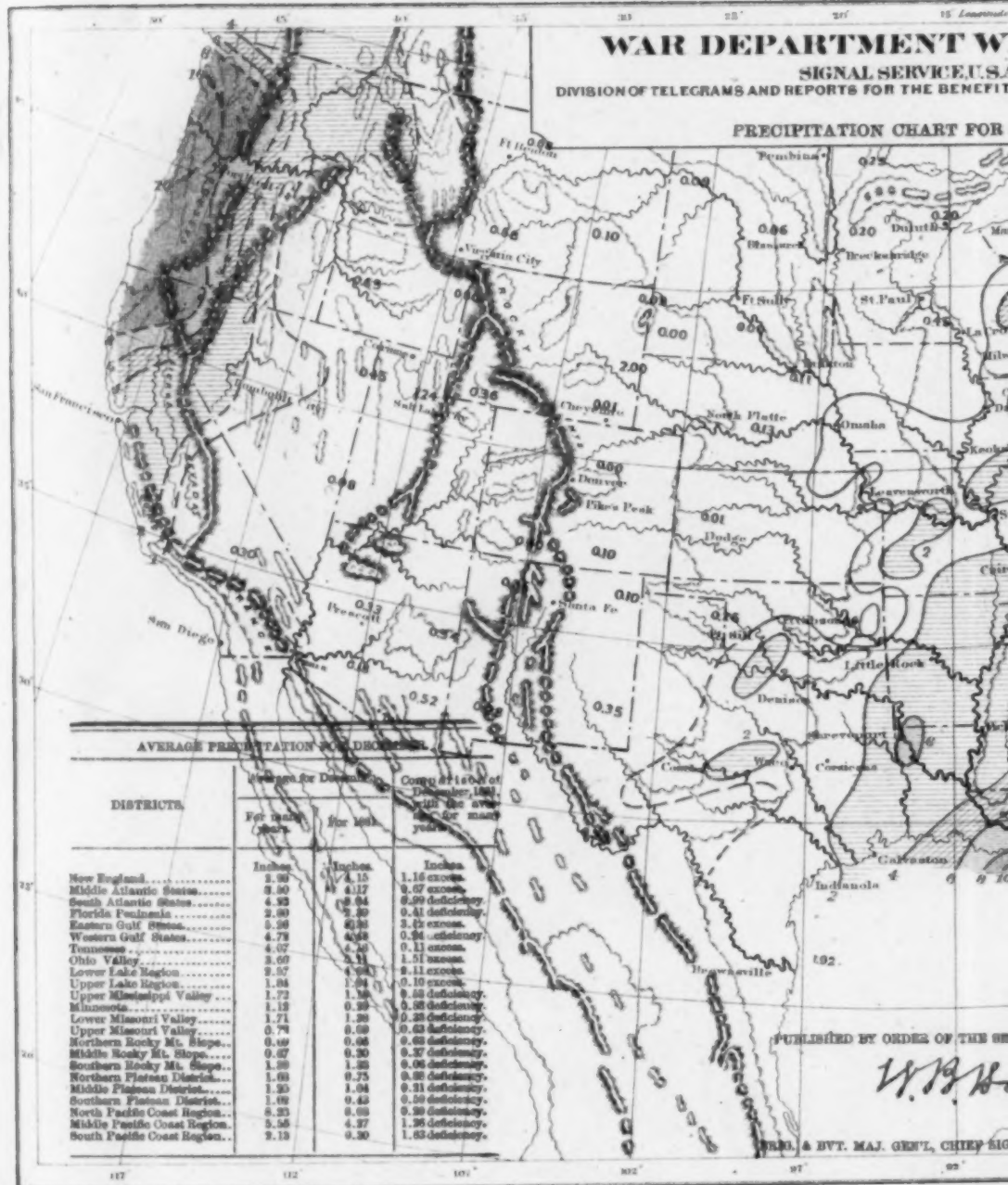
BRIG. & RVT. MAJ. GEN'L. CHIEF

No. II.



WAR DEPARTMENT
SIGNAL SERVICE, U.S.A.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT

PRECIPITATION CHART FOR



PUBLISHED BY ORDER OF THE SECRETARY OF WAR

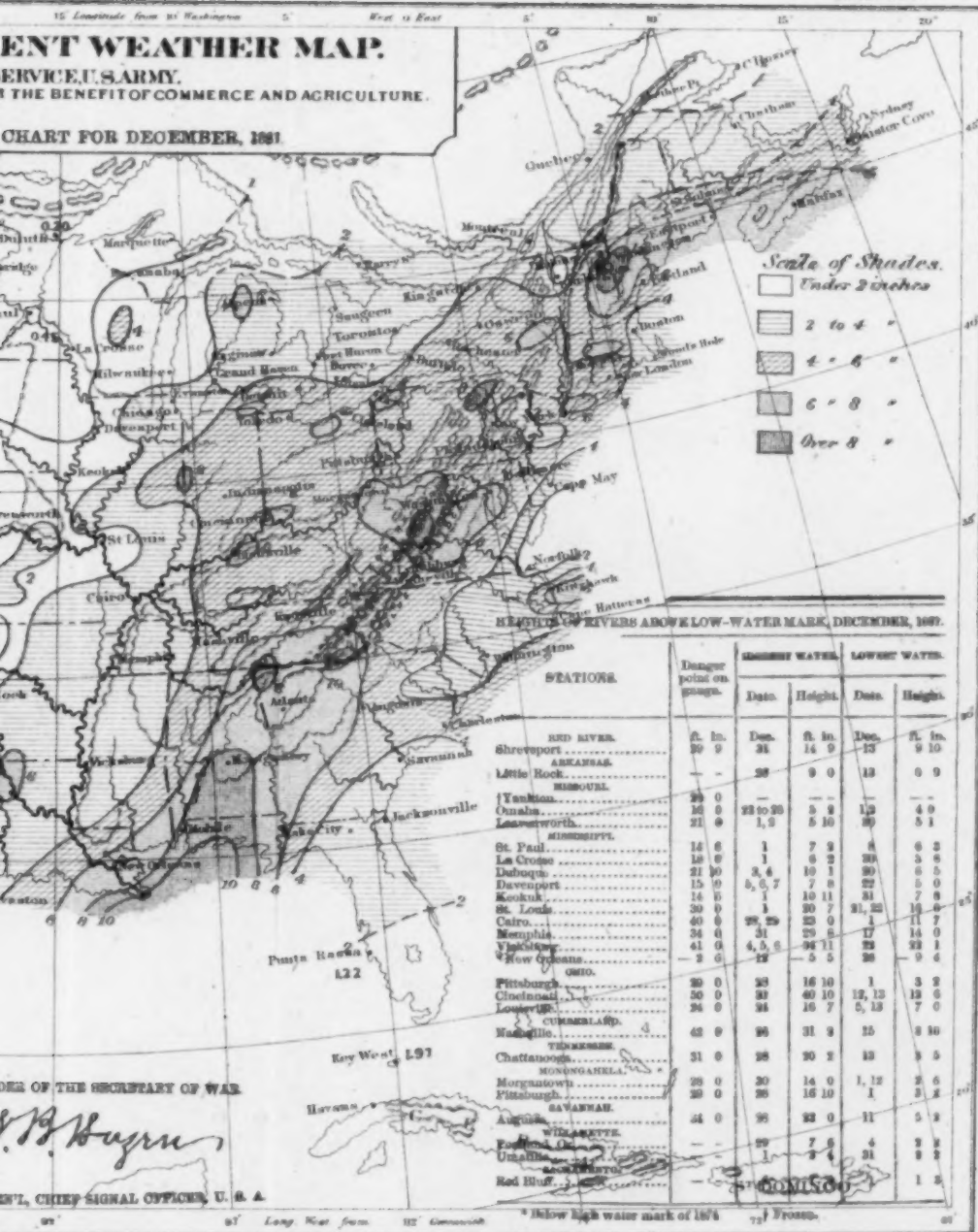
W. B. H.

PREPARED BY H. T. MAJ. GEN'L. CHIEF SIGNAL OFFICE

WATER WEATHER MAP.

SERVICE U.S. ARMY.
FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

CHART FOR DECEMBER, 1897.



ORDER OF THE SECRETARY OF WAR.

J. B. Bayne

CHIEF SIGNAL OFFICER, U. S. A.

Long River from 1870

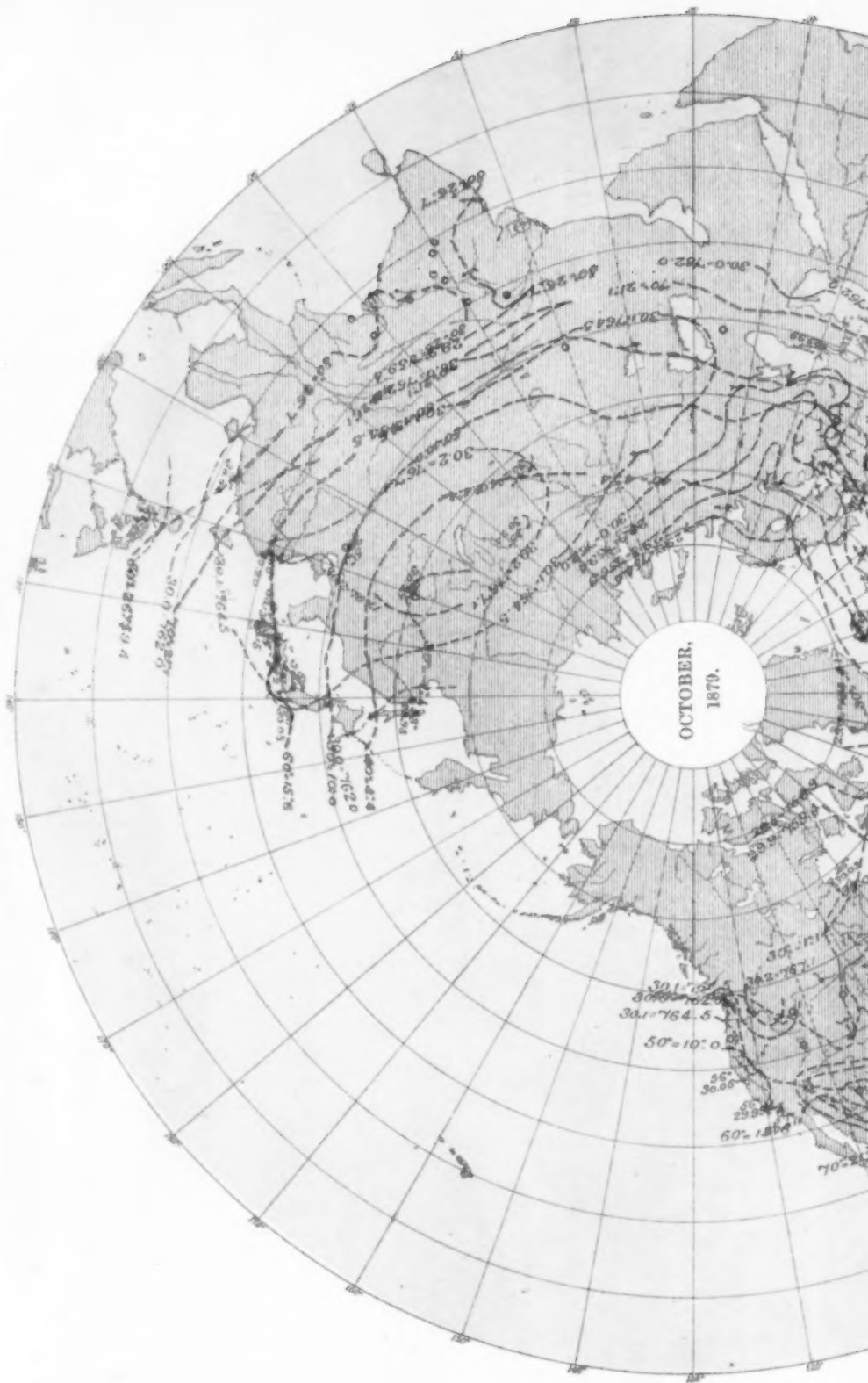
Below high water mark of 1874

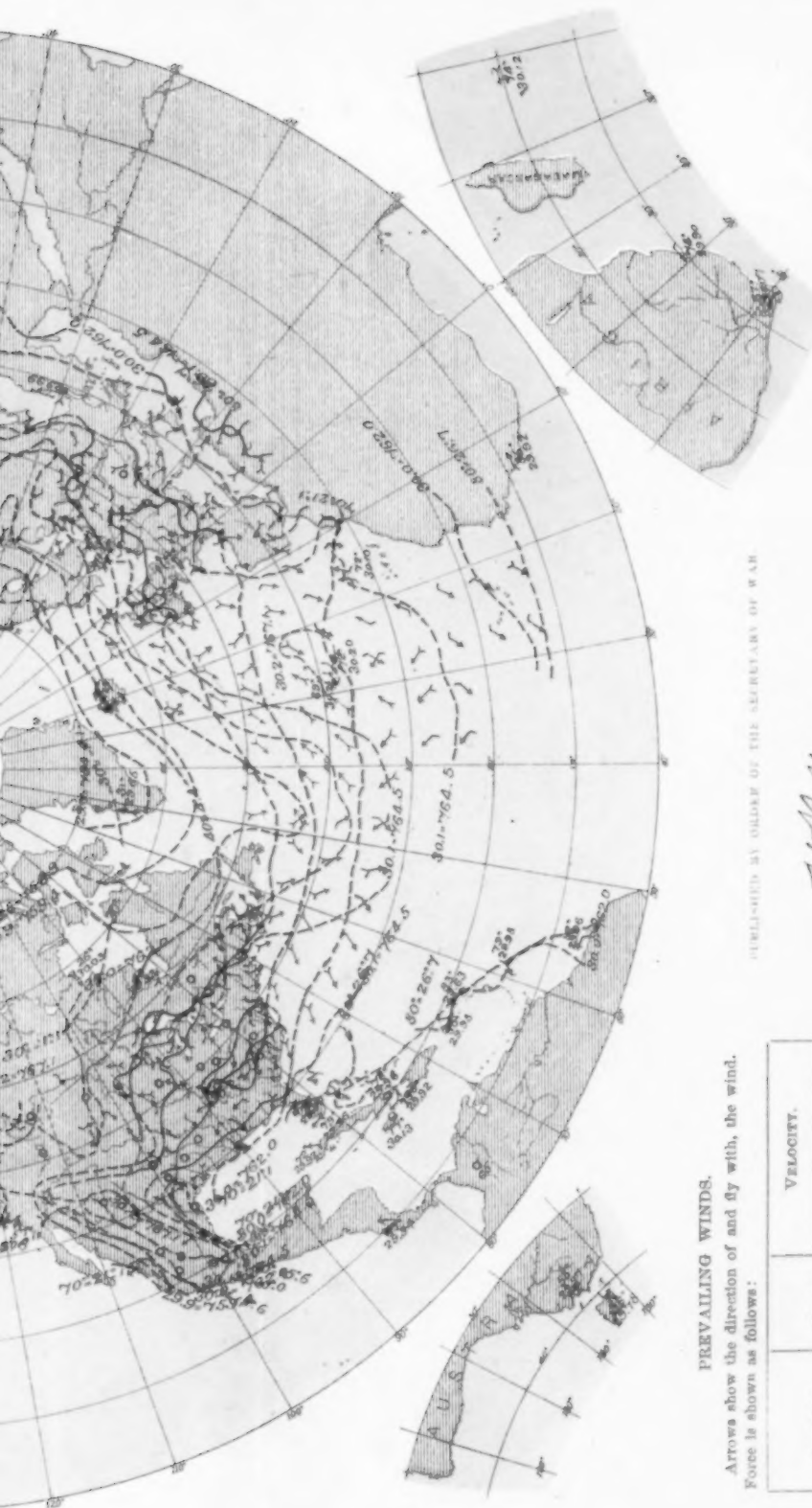
72 F. 7000.

Office of the Chief Signal Officer,
UNITED STATES ARMY.

No. IV.

Charted from Actual Observations taken Simultaneously, Series commencing January, 1877.





PREVAILING WINDS.

Arrows show the direction of and fly with, the wind.
Force is shown as follows:

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
○	0	0	0
↑	1, 2	0 to 9	0 to 4.0
↑	3, 4	9.1 to 22.6	4.1 to 10.1
↑	5, 6	22.6 to 40.5	10.1 to 18.1
↑	7, 8	40.6 to 67.6	18.1 to 30.2
↑	9, 10	67.6 up.	30.2 & over.

ISOBARS AND ISOTHERMS.

Isobars in blue; detached barometer means in English inches.

Isotherms in red; detached temperature means in degrees Fahrenheit.

Broken lines, are doubtful.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of October, 1879, based on the daily charts of the International Bulletin.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

W. H. H. H.

BRIG. & BVT. MAJ. GEN'L.

CHIEF SIGNAL OFFICER, U. S. A.

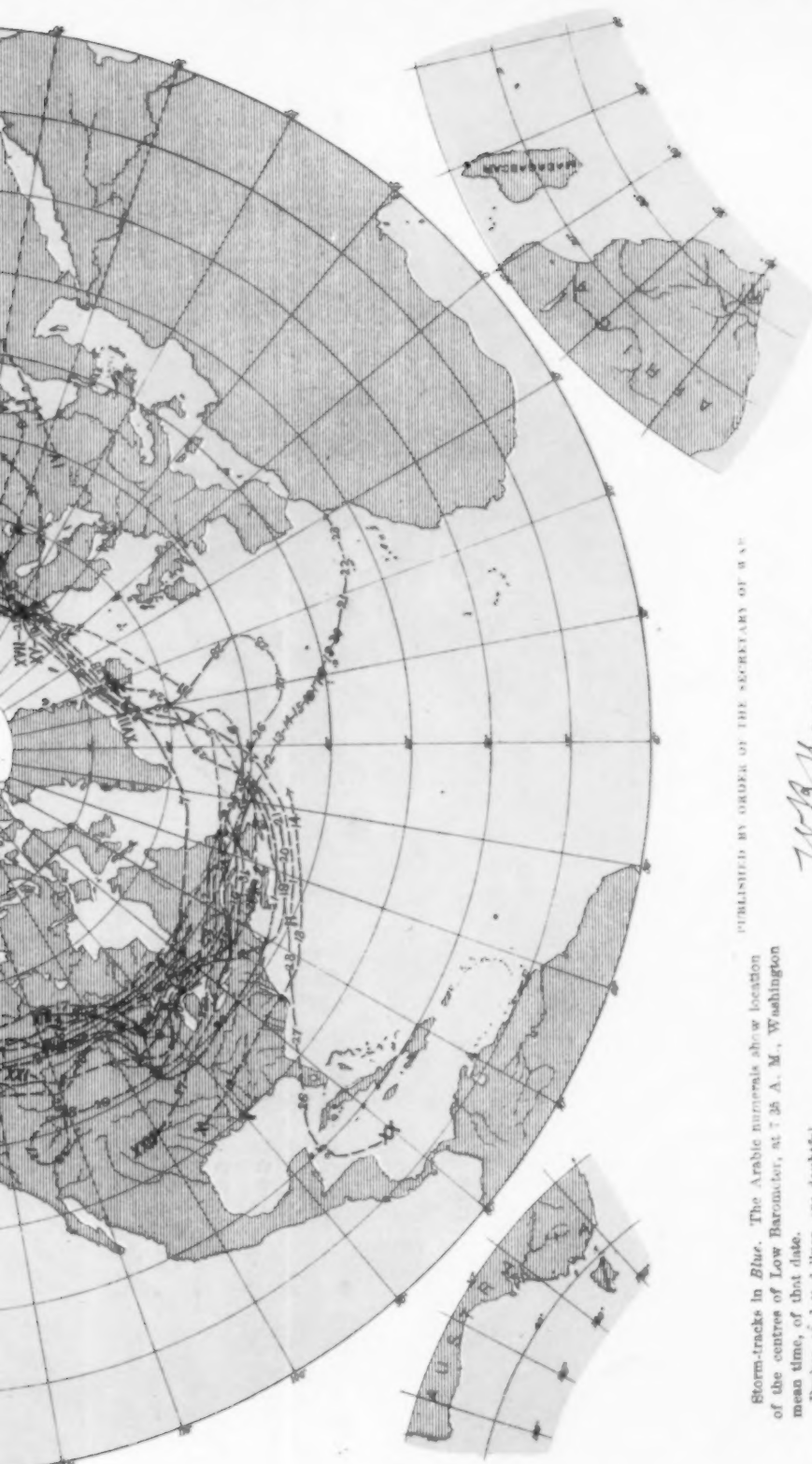
Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing November, 1877.

No. V.





Storm-tracks in Blue. The Arabic numerals show location of the centres of Low Barometer, at 7 1/2 A. M., Washington mean time, of that date.
Broken or dotted lines, are doubtful.

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W. H. H. H.

BRIG. & BVT. MAJ. GEN. L.
CHIEF SIGNAL OFFICER, U. S. A.

INTERNATIONAL CHART
Showing Tracks of Centres of Low Barometer for
January, 1982